국제학석사학위논문

Feasibility of Currency Union Formation in East Asia:

OCA Index analysis on trade and financial sector

동아시아의 단일화폐 형성의 적합성:

통상과 금융 분야의 OCA Index 분석

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이 논문을 국제학 석사학위 논문으로 제출함

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Abstract

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Experiencing two global financial crisis, countries in East Asia were aware of the importance of shaping its economic structure based on a high degree of cooperation by means to alleviate from the aftermath of unexpected external economic shocks.

Based on this background, there were studies on whether East Asia was possible to form a common currency zone, like the European Union, which to cooperate at the regional level by estimating the value of OCA index among East Asian countries and evaluating the advantages and disadvantages under such cooperation.

By assessing the value of OCA index of East Asian countries versus possible anchor currency to have external peg if the group were to form a common currency zone, this paper aims to see mainly three things. Firstly, to check whether East Asia economies are in a favorable condition in forming the currency union zone by analyzing OCA Index from 1995 to 2015. Secondly, to see whether the countries were to form a common currency zone, which currency would be more favorable to become the common external peg. Lastly, by including financial sector variables, how would the value of OCA index be different from that of previous studies.

Overall, the findings show that the value of OCA index versus the United States, China and Japan with East Asian economies showed decreasing trend while United States and China were a relatively more favorable candidate to become anchor currency if East Asia is to form a currency union.

Key words: ASEAN+3, East Asia, OCA index, currency union, trade sector, financial sector

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I Introduction

1.1 Background of the Study

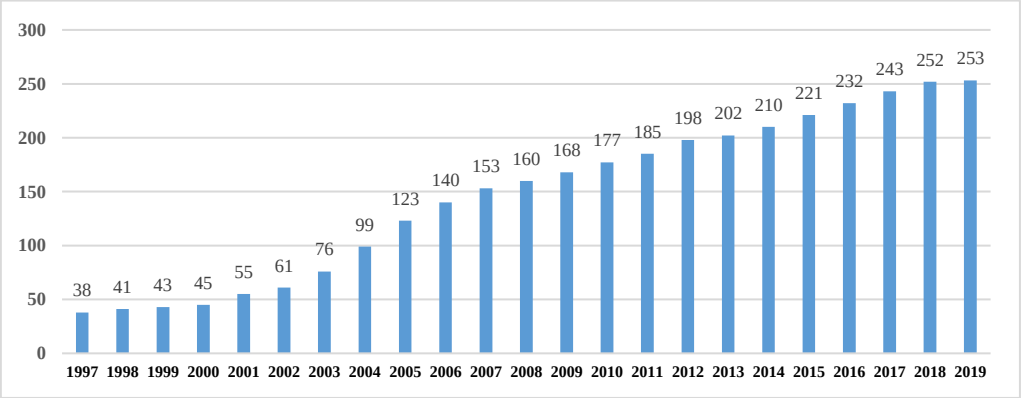
During the financial crisis of 1997, East Asia countries suffered huge economic instability while was able to recover from the crisis through extensive economic and regulatory reforms. Decade later, in 2008, the unprecedented repercussion of the global financial crisis affected Asian economies through both the trade and finance due to deep economic linkages with the rest of the world while was able to manage the crisis and recover with better manner than that of 1997 Asian financial crisis due to appropriate fiscal and monetary stimulus measures.

After the experiences of 1997 Asian financial crisis and 2008 global financial crisis in East Asia, countries in the region became more aware in the importance of shaping its economic structure based on a high degree of cooperation which to alleviate from the aftermath of unexpected external economic shocks.

After the two events, there have been various form of monetary cooperation initiated in East Asia. The number of Free Trade Agreements(FTAs) increased throughout the years while financial cooperation such as Chiang Mai Initiative was launched in May of 2000 along with the Chiang Mai Initiative multilateralization being signed in December of 2009 by involving more number of countries in the mean of cooperation.

Figure 1.1.1

Number of FTAs in East Asia[1]



Source: Asian Development Bank Annual Report 2018

As like that of Chiang Mai Initiative, which is recognized as regional-level cooperation in East Asia, there have been studies examining whether East Asia is feasible in forming common currency zone like the European Union by estimating Optimum Currency Area index(OCA index) among East Asian countries and evaluate the advantages and disadvantages of such cooperation.

As like the use of Euro in European Union, the formation of currency union has been one of an interesting topic in East Asia as a means to be utilized for regional level cooperation. Based on the common question on how to have stabilized economic development in East Asia, many economic scholars have been emphasizing the importance of exchange rate stabilization. As trade is the main source for economic development in East Asia, the stabilized exchange rate is an important factor to consider to have sustainable economic development. By forming regional level currency

[1] Including the agreements under negotiation, implementation, proposed and signed

unification would enable countries in East Asia to be less reliable and be more independent from the global economy when caused by unpredictable external economic shocks.

The advantages of joining the currency union, known as the final stages of economic integration, would include the removal of transaction costs, the boost of investments and most importantly having exchange rate stability through the usage of a common currency. By having the same currency can boost trade by enabling nations to compare prices efficiently and preventing asymmetric shock through free mobility of labors and the prevention of competitive devaluations and speculations.

One of the disadvantages in joining the currency union is the loss of control on its national money supply. Countries within currency union are bound to have joint control of its monetary policy, which loses its power to stabilize their economy by using independent management on the exchange rate and monetary policy. Degree of the cost will be huge when countries with high difference in economic environments form a currency union. Its most costs come during the crisis when the economic situations are different in all the concerned countries and cannot be handled in the same way. In other words, by having a high degree of different economic background would lead countries to have different economic problems which need an independent monetary policy to handle the problems suited to those different economic problems. Thereby, it would be beneficial for countries to have independent monetary policy power if the countries are under a high degree of economic environment difference.

East Asian countries are known to have diversified economic development stages among them. According to Masashiro(2004), East Asian countries have diverse and varied economic systems, different development in economic and social stages, industrial structures, degree of trade openness and patterns, etc. It is regarded to have a currency union not suitable with countries having a great differences in economic backgrounds. Bayoumi and Eichengreen(1996) mentioned that unlike Western Europe, East Asia is less of an optimum currency area due to highly different economic and financial conditions within the region. Kwan(1994) mentioned with the example of Japan that some East Asian countries competing with Japan in world market show a similar pattern of their currency moving as Yen while other countries importing from Japan would show less competition by depreciating their currencies when Yen strengthens to offset the high import prices which trigger a recession.

However, these previous studies were all based mainly on the period of 1990s to early 2000s. An increasing number of economic integration activities, changes in export compositions, economic cooperation as means to have stabilized economic development within the region and the rapid rise of the Chinese economy in a recent period rather shows reconsideration on the feasibility of forming currency union in East Asia.

As lessons left by the two financial crisis in 1997 and 2008, East Asian countries learned the importance to have stronger economic linkages. This led the region to look for regional economic integration and to create institutions that would facilitate

synergy on trade and financial activities in order to enable countries to better address emerging economic issues[2]. Accordingly, the number of FTAs along with currency swap deals among East Asian countries rose drastically during the 1990s and 2000s[3].

According to World Bank, not only East Asia became the region of global significance which accounts for up to 30% of the global economy by most measures including production, trade, investment and finance, but also economical regional integration has shown improvements as well. In 2016, Asia's intra-regional trade share rose to 57.3%, which was the record high up from an average of 55.9% from 2010 to 2015[4].

Such improvements in the economic environment might show a rather better condition in forming currency union in East Asia. Additionally, in the discussion on which currency to be the anchor currency, if to form currency union in East Asia, can be another topic to be discussed. One of the main reason for East Asian countries are yet to be suitable in forming a currency union is due to high reliance on US dollars in international markets. The international monetary system has been dominated by the use of US dollars combined with the rise of the Euro after the introduction European Union. As we can see from the composition of foreign exchange reserves in the global market, the US dollar and Euro comprised more than 80% in total of foreign exchange reserves. One of the representing currency in Asia, Yen, rather showed a declining trend while

[2] Jenny D. Balboa and Erlinda M. Medalla(2011)
[3] As of 2018, 98 Free Trade Agreements(FTAs) in East Asia were in effect.
[4] Asian Economic Integration Report(2017)

increased with gradual margin in recent years in the currency composition of official foreign exchange reserves.

Table 1.1.1
Currency Composition of Official Foreign Exchange

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Shares of Allocated Reserves	55.64	55.30	55.57	53.26	58.65	67.89	78.58	87.50	93.95
Shares of U.S. dollars	62.24	62.69	61.50	61.27	65.17	65.74	65.36	62.72	61.69
Shares of Euro	25.76	24.44	24.06	24.21	21.21	19.15	19.14	20.16	20.69
Shares of Chinese renminbi	-	-	-	-	-	-	1.07	1.23	1.89
Shares of Japanese yen	3.66	3.61	4.09	3.82	3.55	3.75	3.96	4.90	5.20
Shares of pounds sterling	3.94	3.84	4.04	3.99	3.70	4.72	4.34	4.53	4.43
Shares of Australian dollars	-	-	1.46	1.82	1.60	1.77	1.69	1.80	1.62
Shares of Canadian dollars	-	-	1.43	1.83	1.75	1.78	1.94	2.03	1.84
Shares of Swiss francs	0.13	0.08	0.21	0.27	0.24	0.27	0.17	0.18	0.15
Shares of other currencies	4.27	5.33	3.21	2.80	2.79	2.83	2.34	2.44	2.48

Source: IMF

Based on these facts, it is inevitable for East Asian countries to be vulnerable from unexpected external shocks that are triggered by developed countries such as the United States or other European countries. As most of the countries around the world have a high degree of demands in US dollars or Euro, it would have a huge impact on their economies once economic problems occur from developed countries with high usages of the US dollar or Euro. However, due to the rapid economic development of China may bring different views regarding the formation of a currency union in East Asia. Initiating ‘Open door’ policy in 1978, China has made various improvements in various economic aspects including an increased portion on official foreign exchange and increased foreign exchange reserves up to 4 trillion dollars in 2013, which became the country with the most amount of foreign exchange reserves in the world. Accordingly,

China has rather become one of the influential countries not only in East Asia but also in the international monetary system. As to have a competitive economic status in the world economy, China may become a strong candidate for becoming the anchor currency country if the currency union is to be formed in East Asia.

1.2 Hypothesis

From the previous experiences by going through two financial crisis in 1997 and 2008, the role of the stabilized exchange rate has become a crucial factor to facilitate consistent economic development in East Asia. As most of the East Asian countries heavily rely on export for their economic development, a stable exchange rate is an essential factor condition to enable such development. As the case of the European Union, many scholars have been exploring regional level cooperation to realize stabilized exchange rates in East Asia.

Among the various studies on the topic of regional cooperation in East Asia, the feasibility of optimum currency area formation was one of the popular studies done by various scholars. As mentioned in the previous studies, due to great diversity in GDP, GDP per capita income and economic development, many were skeptical of the currency union formation in East Asia while the actual OCA index showed that East Asia was yet to be ready in forming currency union as well.

However, these previous papers have its limits which the results from these papers do not represent the very recent economic developments in East Asia economies while also does not consider China as the major economy which can be a crucial factor

that will have a huge impact on forming currency union in East Asia. As for China, reached $ 4 trillion on foreign reserves in 2013, which became the highest foreign reserves country in the world, while with the intention to control the inflation rate, China has put efforts to internationalize its RMB currency in the world market and became the 8th most traded currencies in the world in 2013.

In terms of industrial development in East Asia, due to increasing linkages in production under a competitive environment and by maintaining cooperative relations with neighboring countries, countries were able to upgrade their industrial capabilities from low-tech to high-tech. Moreover, there has been an increasing trend of 'Swap-Deals' in East Asia which can be a crucial element in forming stronger currency union among the members within the region. An increasing number of establishing currency swap deal agreements, not only in the form of multilateral dimension but also bilateral as well, will increase the probability of having stable exchange rates in the region. Due to increased numbers of such agreements, East Asian economies would have strengthened their financial sector of the economy that might enable countries concerned to have a better conditions in forming a currency union.

Based on these reasons, it is possible to expect that East Asia has moved toward more to a favorable condition in forming a common currency zone in recent years.

II Literature Review

Since the various countries economic recovery from the 1997 Asian financial crisis and the 2008 global financial crisis, the idea of regional monetary cooperation gained increasing interest among countries in East Asia. If the underlying causes of both crises were originated from internal problems[5], the problems were to be addressed mainly with internal reforms. However, as the crises were triggered because of both internal and external economic factors, internal reforms, as well as regional level responses, were important[6]. Question on how to have a stabilized exchange rate was to be answered through those responses while the importance of regional level cooperation became significant.

One of the leading topics from many researchers in terms of regional cooperation of East Asia was the monetary integration in East Asia. Optimum Currency Area theory(OCA theory) is used to assess the feasibility of monetary union or currency union in certain regions. OCA theory was coined by Mundell(1961), McKinnon(1963) and Kennon(1969) which focuses on economic characteristics that make currency union either more or less desirable across regions or countries[7]. In other words, the OCA theory focuses on examining economic variables that make stable exchange rates and monetary unification more or less desirable in the region. According to Bayoumi and

[5] Krugman(1998) mentioned as the 'Asian sin'
[6] Rhee(2003)
[7] Bayoumi and Eichengreen (1997), Optimum currency areas and exchange rate volatility: Theory and Evidence compared, Chapter 7

Eichengreen(1997), the most important characteristics used in their paper were the relative importance of asymmetric disturbance to real output, the dissimilarity of the export composition of pair of the trade partners, the level of trade linkages and economic size.

Asymmetric real output disturbance, which shows the difference in real output, and export composition dissimilarity of two countries are used to see whether countries in the region have symmetric business cycles or national outputs. As countries with symmetric business cycles and the level of national outputs moving together, the value for this measure will be small. According to Mundell(1961), one of the major concerns in forming currency union is the unavailability in managing independent monetary policy on each member country since countries with different economic environments would need different measures of economic policies. However, countries willing to form currency unions rather having symmetric business cycle movements will likely reduce the cost since common monetary policy could rather play a stabilizing role similar to that of managing individual monetary policy. Trade linkages were used as the proxy for the importance of commercial links between pair countries concerned. A high degree of trade linkages will likely increase the efficiency gain due to the usage of common currency which will lower the transaction costs during the trade. The economic size was used as a proxy for benefit of common currency which will be greatest for small economies where there is the least scope for utilizing a separate national currency in transactions. In other words, small economic size countries will benefit the most from

the unit of account, means of payment and store of value services provided by a common currency as a balancing means from the costs of losing macroeconomic policy independence.

Also, there were studies on what currency unit should be used if East Asia was to form a currency union. Bayoumi and Eichengreen(1996) tried to look for the optimum currency unit to be used as a common external peg by evaluating the OCA index[8]. They tried to implement several economic variables into a complex empirical form that allows determining the qualification of 'OCA indices' whose values express the suitability or unsuitability of membership of the monetary union for the particular economy. In their paper, it measures the value OCA index for each Asian country versus major economies[9]. As Korea, Thailand and Indonesia showed preference to peg with Yen while Hong Kong and Singapore showed more prone to peg against the US dollar.

[8] Lower the final value of an OCA index, the higher the level of readiness of an economy to access a monetary union. The minimum deviation of the nominal exchange rate in the floating exchange rate regime is significant precondition for the future efficiency of the economy within the monetary union since there is no pressure on the recalculation of the central parity determined upon the adoption of the single currency

[9] Japan, United States and Germany

III Purpose of the Study

The main purpose of the study is to see whether East Asia has moved toward a more favorable condition to form a currency union. As the region sustained high economic growth over the past few decades, associated with the rapid rise of China's economy, it led East Asia to have a suitable economic environment in forming a currency union. Also, increasing share of intra-regional trade combined with an increased number of regional cooperation agreements would have led East Asia to have a better condition in forming a common currency zone. Due to improvements of several economic factors including GDP, world trade shares, the amount of foreign exchange reserves and more might have changed the value of the OCA index of East Asian countries in the recent period.

The second purpose of the study is to see the OCA index by incorporating additional variables related to the financial sector. The value of the OCA index from previous studies was found from the relations between trade-related variables and exchange rate volatility. In other words, it tried to look for predicted values of exchange rate volatility with variables that would have high correlations with trade[10]. However, I wanted to see the relations between exchange rate volatility with additional variables considered such as the ratio of bank deposit to GDP, the ratio of broad money to GDP,

[10] Such as difference in output, degree of dissimilarity in trade composition, trade linkages and economic size

the ratio of domestic credit to GDP[11] and foreign exchange reserves to GDP. According to Hanh (2018), the nature of the linkage between liquidity and real exchange rate depended on the level of the country's financial development which actually showed significant validation in their studies[12]. Especially, by experiencing two major financial crisis in 1997 and 2008, countries in East Asia have increased their foreign exchange reserves as a means to have a better condition in addressing unexpected external economic shocks through maintaining stabilized exchange rate. Also to follow the international trend, countries in East Asia have shown improvement in financial market institutional developments. Accordingly, the OCA index of East Asian countries would have improved due to the development of financial sector factors. It would be interesting to consider the OCA index of financial sector in this regard.

Lastly, it would be meaningful to look at which country currency to be the anchor currency for the possible formation of a currency union. By the additional inclusion of financial sector variables in this study, it would be expected that value of OCA index would have decreased in East Asia since financial developments have known to be well established in the region while would be interesting to evaluate the possible candidate for anchor currency by assessing values of OCA index versus several candidates.

[11] Aghion(2009) revealed that country's level of financial development matters in choosing how flexible in exchange rate system should be if the objective is to maximize long-run productivity growth. Therefore, another goal of this paper is to test whether exchange rate volatility declines if the country is more financially developed.

[12] The interaction between liquidity and exchange rate also addressed in Grilli and Roubini (1992), who present a two-country extension of Lucas's(1988) work on cash-in-advance constraints in asset markets

IV Research Methodology

The paper used the OCA index coined from Bayoumi and Eichengreen(1996). The equation below was used to estimate the value of OCA index.

$$\mathbf{SD}(\boldsymbol{e}_{ij}) = a_0 + b_1\mathbf{ABS}(\blacktriangle \boldsymbol{y_i} - \blacktriangle \boldsymbol{y_j}) + b_2\boldsymbol{DISS}_{ij} + b_3\boldsymbol{TRADE}_{ij} + b_4\boldsymbol{SIZE}_{ij} + b_5\boldsymbol{OPEN}_{ij} + b_6\boldsymbol{LL}_{ij} + b_7\boldsymbol{BD}_{ij} + b_8\boldsymbol{DC}_{ij} + b_9\boldsymbol{FER}_{ij}$$

$\mathbf{SD}(\boldsymbol{e}_{ij})$ is the standard deviation of changes in the logarithm of the end-year bilateral exchange rate between countries i and j. $\mathbf{ABS}(\blacktriangle \boldsymbol{y}_i - \blacktriangle \boldsymbol{y}_j)$ is the absolute difference of the real GDP growth rate between countries i and j. This is the measure of 'asymmetric output disturbances' which when business cycles between comparing countries are symmetric and national outputs move together, the value of this measures will be small. $\boldsymbol{DISS}_{ij}$ is the sum of the absolute difference in the shares of agricultural, mineral and manufacturing trade in total merchandized trade[13]. With higher values indicating less similarity in the composition of commodity exports between the two countries. It is also the measure of 'asymmetry of shocks' when pair countries have

[13] Share of these merchandize categories are defined by UNCTADSTAT. Manufacturing goods are defined as the total of basic manufactures, chemicals, machines and transport equipment, miscellaneous manufactured goods, and other goods. Agriculture is the sum of food and live animals, beverages and tobacco, and animal, vegetable oils and fats. Minerals amalgamate data on crude materials excluding fuel with mineral fuels etc.

similar comparative advantages in certain sector for export, certain industry-specific shocks will be symmetric. $\boldsymbol{TRADE}_{ij}$ is the mean of the ratio of bilateral exports to domestic GDP for the pair countries concerned. This measures the importance of trade linkages. $\boldsymbol{SIZE}_{ij}$ is the mean of the logarithm of the two GDPs measured in U.S dollars which to measure the benefit from a more stable currency. Such benefit will be greatest to small countries where there will be least use of separate national currency in transactions such as from unit of account, means of payment and store of value services provided by a common currency. $\boldsymbol{OPEN}_{ij}$[14] is the average of trade to GDP ratio[15] for the pair countries concerned. Main idea under this variable is that more open economies will be more favorable of becoming an external anchor. $\boldsymbol{LL}_{ij}$ which is the average ratio of broad money to GDP of pair countries concerned while $\boldsymbol{BD}_{ij}$ is the average ratio of bank deposit to GDP which comprises commercial banks and other financial institutions that accept transferable deposits, such as demand deposits. Both $\boldsymbol{LL}_{ij}$ and $\boldsymbol{BD}_{ij}$ are used as proxy to show the degree of liquidity of countries involved. $\boldsymbol{DC}_{ij}$[16] is the mean ratio of domestic credit to private sector to GDP which measures the degree of financial institution development of concerned countries. $\boldsymbol{FER}_{ij}$ is the average ratio of foreign exchange reserves to GDP of pair countries concerned.

[14] This indicator was used by McKinnon while from Bayoumi and Eichengreen(1997) rather used economic size as a measure of the benefits from a stable currency by showing the comparison between Germany(large economic size with relatively open economy) and Spain(small economic size with more closed economy).
[15] Trade is the sum of annual amount of import and export
[16] Which also refers to financial resources provided to the private sector

Countries involved in this paper analysis are total of 11 countries. It includes ASEAN+3 of China, Japan, South Korea, Indonesia, Malaysia, Singapore, Thailand, Philippines, Vietnam and Hong Kong and Australia[17]. Due to lack of data, ASEAN countries of Cambodia, Lao PDR, Myanmar and Brunei were excluded in this paper. For the analysis, the paper includes time period from 1995 to 2015. By looking through 21 years of time span would enable us to see how the value of OCA index turned out from the two financial crisis[18] while also would be able to see how the recent trend in value of OCA index changed.

In this paper, OLS regression was used to find the estimated value of OCA index vis-a-vis top 3[19] candidates(United States, China and Japan) on which currency to become the common external peg when forming common currency union in East Asia. The paper ran mainly 3 equations for regression on OCA index by using total variables[20](total sector), trade variables[21](trade sector) and financial variables[22](financial sector). By analyzing three different equations, we can see how each sectors attribute to

[17] I have planned to include both Australia and New Zealand as part of East Asia economy since both countries from Oceania have high degree of economic linkages with East Asian countries. However, New Zealand was excluded due to lack of data in financial sector

[18] 1997 Asian financial crisis and 2008 global financial crisis

[19] Based on the top 3 portion of Official Foreign Exchange reserves in East Asia

[20] $SD(\boldsymbol{e}_{ij}) = a_0 + b_1 \mathbf{ABS}(\blacktriangle \boldsymbol{y_i} - \blacktriangle \boldsymbol{y_j}) + b_2 \boldsymbol{DISS}_{ij} + b_3 \boldsymbol{TRADE}_{ij} + b_4 \boldsymbol{SIZE}_{ij} + b_5 \boldsymbol{OPEN}_{ij} + b_6 \boldsymbol{LL}_{ij} + b_7 \boldsymbol{BD}_{ij} + b_8 \boldsymbol{DC}_{ij} + b_9 \boldsymbol{FER}_{ij}$

[21] $SD(\boldsymbol{e}_{ij}) = a_0 + b_1 \mathbf{ABS}(\blacktriangle \boldsymbol{y_i} - \blacktriangle \boldsymbol{y_j}) + b_2 \boldsymbol{DISS}_{ij} + b_3 \boldsymbol{TRADE}_{ij} + b_4 \boldsymbol{SIZE}_{ij}$

[22] $SD(\boldsymbol{e}_{ij}) = a_0 + b_6 \boldsymbol{LL}_{ij} + b_7 \boldsymbol{BD}_{ij} + b_8 \boldsymbol{DC}_{ij} + b_9 \boldsymbol{FER}_{ij}$

total OCA index trend and see how much degree of similarity or differential the economic backgrounds are among countries concerned in each sectors.

V Results and Analysis

In this paper, OLS regression was used to find the estimated value of OCA index vis-a-vis top 3[23] candidates(United States, China, and Japan) to see on how the trend of OCA index have changed in 21 year period and also to find which currency was more favorable to become common external peg when forming currency union in East Asia.

According to the analysis, all 3 candidates each showed similar trend in terms of average value of OCA index. Average of OCA index for total sector, including both trade and financial sector, increased during the occurrence of each financial crisis in 1997 and 2008 while decreased after the crises were settled. However, among those 3 candidates, China and United States were the candidates that showed comparably lower average value of OCA index compared to Japan. This means that it would be beneficial for countries concerned to form common exchange rate system with China or United States than that of Japan. Degree of value decreased was shown the largest from Japan[24], while average value of the OCA index remained the highest[25] among the three candidates. It showed that OCA index versus Australia with three candidates showed the highest value compared to other countries concerned meaning Australia would not benefit much from joining currency union in East Asia if it were to be formed.

[23] Initial purpose of the paper was to include South Korea as well. However, due to low value R^2 from the estimation, South Korea was excluded from the analysis

[24] Japan (-0.0273), China (-0.0241) and United States (-0.0118)

[25] Japan (0.0391), China (0.0238) and United States (0.0252)

5.1 United States

I have estimated coefficients for the United States and its 10 leading trading partners[26] over the period of 1995 to 2015. The results of the regression are as follows (t-statistics are in the parentheses):

$$\begin{aligned} SD(\boldsymbol{e}_{ij}) = {} & 0.282 + 0.001*\mathbf{ABS}(\blacktriangle \boldsymbol{y}_i - \blacktriangle \boldsymbol{y}_j) + 0.034*\boldsymbol{DISS}_{ij} - 0.276*\boldsymbol{TRADE}_{ij} \\ & \quad (0.54) \quad (0.93) \qquad\qquad (2.28) \qquad\quad (-2.54) \\ & - 0.007*\boldsymbol{SIZE}_{ij} + 0.031*\boldsymbol{OPEN}_{ij} - 0.000*\boldsymbol{LL}_{ij} + 0.003*\boldsymbol{BD}_{ij} \\ & \quad (-0.41) \qquad\quad (0.69) \qquad\quad (-0.21) \qquad\quad (1.04) \\ & - 0.003*\boldsymbol{DC}_{ij} - 0.001*\boldsymbol{FER}_{ij} \\ & \quad (-1.05) \qquad\quad (-1.08) \end{aligned}$$

$$N = 210, \quad R^2 = 0.65, \text{ S.E} = 0.022$$

From the regression of the above equation, asymmetric disturbance to output, dissimilarity of exports, trade linkages and bank deposit to GDP showed coefficient being significant at 1% probability level while liquid liability and foreign exchange reserves showed coefficient being significant at 5% and 10% probability level each.

Next, I have run the regression for the United States with countries in East Asia using the same method as the above. The period used is same as above equation, from 1995 to 2015. Based on the regression, I estimated coefficients and values of the independent variables from 1995 to 2015 to predict the dependent variable[27] of

[26] Countries includes Brazil, Canada, China, Germany, United Kingdom, Hong Kong, Japan, South Korea, Mexico and Netherlands

[27] Dependent variable, here, is the predicted level of exchange rate volatility. This is also the proxy for 'OCA Index', which the lower values indicates that countries concerned would be beneficial in forming as optimum currency area

ASEAN+3[28], Hong Kong and Australia for the case of the United States as the common external peg.

$$SD(\boldsymbol{e}_{ij}) = 0.112 + 0.003*\mathbf{ABS}(\blacktriangle \boldsymbol{y}_i - \blacktriangle \boldsymbol{y}_j) + 0.006*\boldsymbol{DISS}_{ij} - 0.180*\boldsymbol{TRADE}_{ij}$$
$$(0.55) \quad (4.04) \qquad\qquad (0.83) \qquad\qquad (-1.53)$$
$$-0.003*\boldsymbol{SIZE}_{ij} - 0.001*\boldsymbol{OPEN}_{ij} - 0.001*\boldsymbol{LL}_{ij} + 0.000*\boldsymbol{BD}_{ij}$$
$$(-0.46) \qquad\qquad (-0.08) \qquad\qquad (-4.23) \qquad\qquad (5.21)$$
$$-0.000*\boldsymbol{DC}_{ij} - 0.000*\boldsymbol{FER}_{ij}$$
$$(-2.12) \qquad\qquad (-1.87)$$

N = 229[29], R^2 = 0.37, S.E = 0.028

From independent variables, asymmetric disturbance to output, bank deposits to GDP, broad money to GDP showed coefficient being significant at 1% probability level while domestic credit to GDP and foreign exchange reserves showed coefficient being significant at 5% and 10% probability level each.

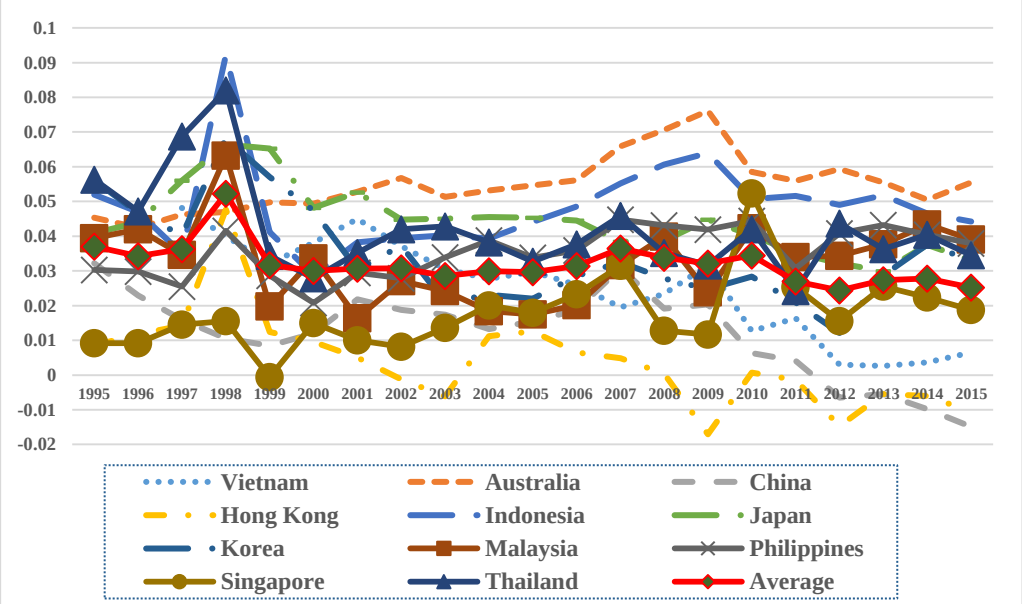
The difference in results from the two groups of 10 leading trading partners and that with East Asian countries were openness to trade where countries in East Asia with more open to trade tend to have less variation on exchange rate volatility while groups of top 10 leading trading partners showed the opposite result.

The figures of OCA index versus the United States with East Asian countries in the total sector[30], the trade and financial sectors are shown on the bottom figures.

[28] Cambodia, Lao PDR, Myanmar and Brunei were excluded from the analysis
[29] Vietnam was excluded for 1995 and 1996 data in trade sector
[30] Using all the independent variables included in trade and financial sector

Figure 5.1.1

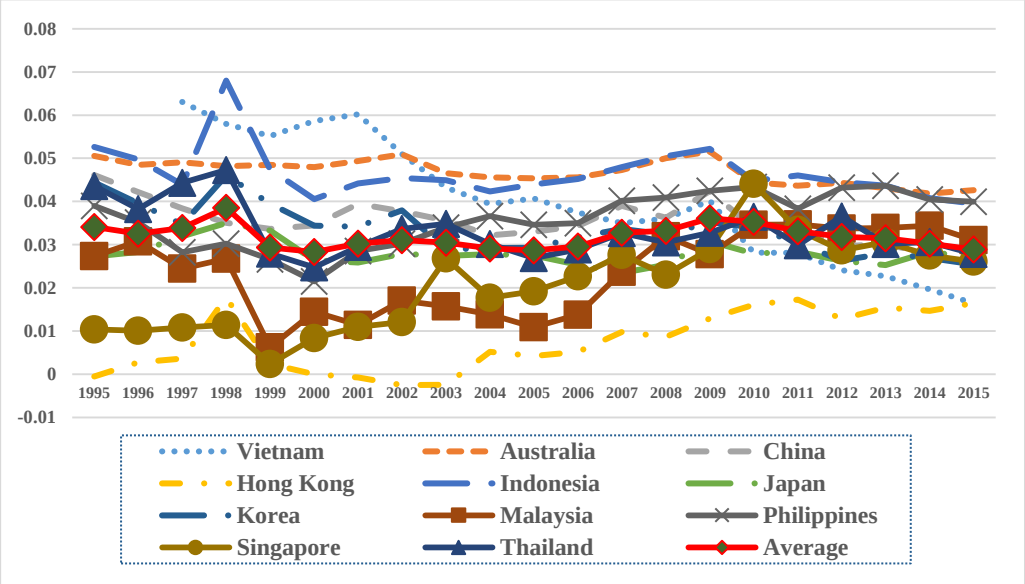
OCA Index versus United States in Total Sector



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

Figure 5.1.2

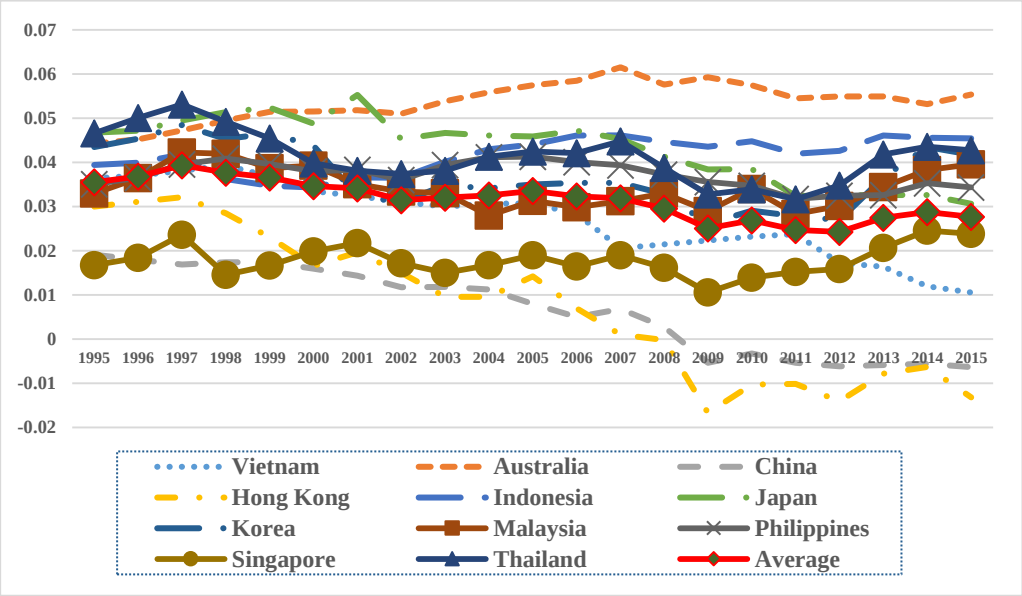
OCA Index versus United States in Trade Sector



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

Figure 5.1.3

OCA Index versus United States in Financial Sector



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

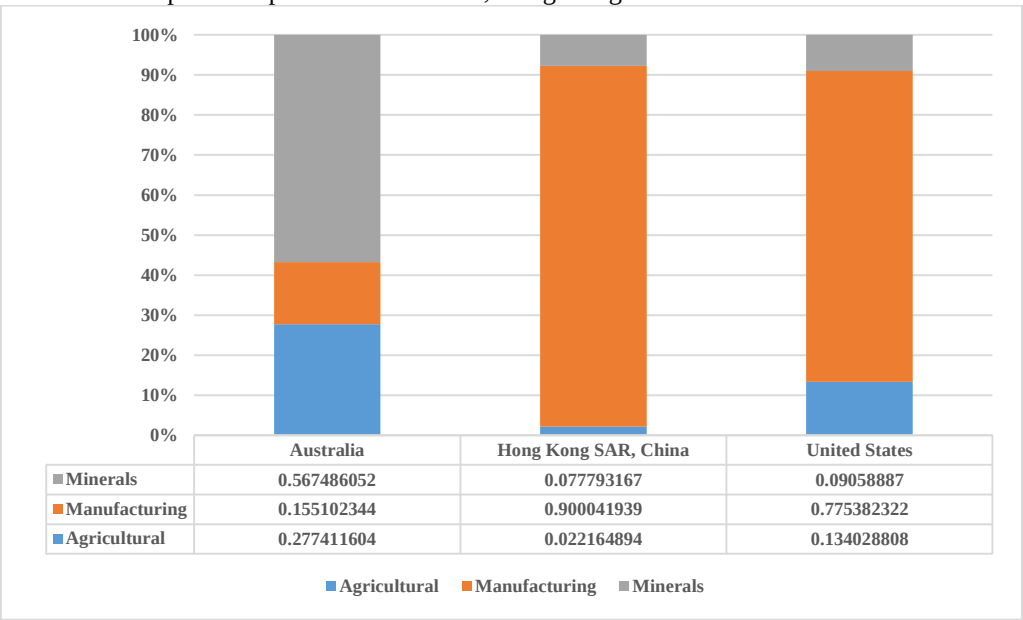
The average value of OCA index in the total sector showed relative increase in both the financial crisis of 1997 and 2008 while showed rather a tardy declining trend from 2010. The most favorable pair with the United States in forming currency union would be Hong Kong and China while Vietnam has shown the most dramatic decrease in the value of the OCA index vis-a-vis with the United States. However, a country that would least benefit from pegging to the United States dollar was Australia, showing the highest value of the OCA index versus the United States.

As for Hong Kong, except for 1997 financial crisis, values of OCA index from both trade and financial sector showed low value throughout the period which by forming a currency union with the United States would be relatively more beneficial

than that to other countries concerned. In terms of the dissimilarity of trade structure between the United States and Australia showed a drastic difference from that to the United States and Hong Kong. As the United States and Hong Kong have similar export components, where the majority is composed of manufacturing goods, Australia's[31] export components are composed more than 80% of primary products, including both unprocessed and processed.

Figure 5.1.4

Export Components of Australia, Hong Kong and United States in 2015

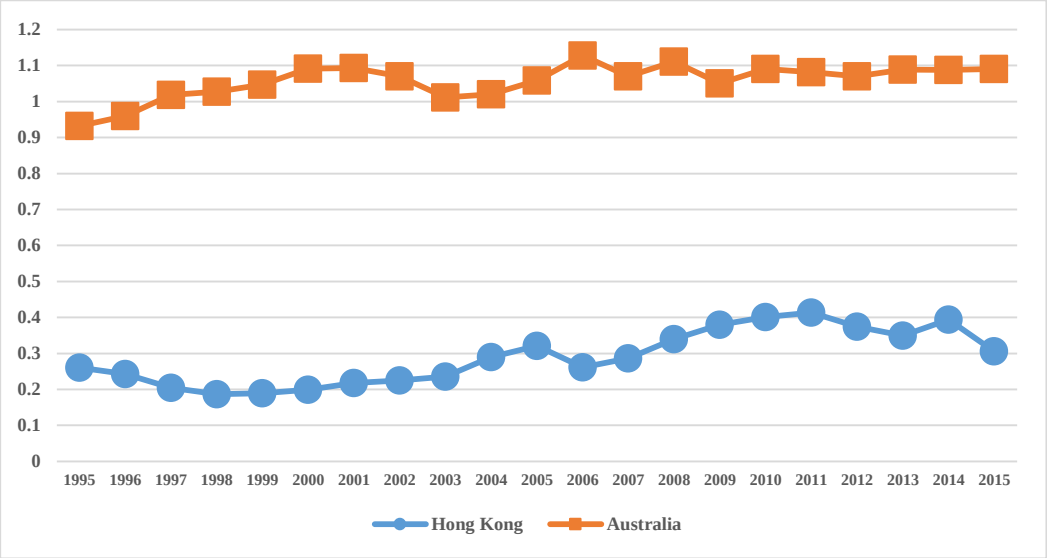


	Australia	Hong Kong SAR, China	United States
Minerals	0.567486052	0.077793167	0.09058887
Manufacturing	0.155102344	0.900041939	0.775382322
Agricultural	0.277411604	0.022164894	0.134028808

Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

[31] while imports most of manufactured goods from their trade partners

Figure 5.1.5
Dissimilarity Composition to Export between United States
Compared with Hong Kong and Australia

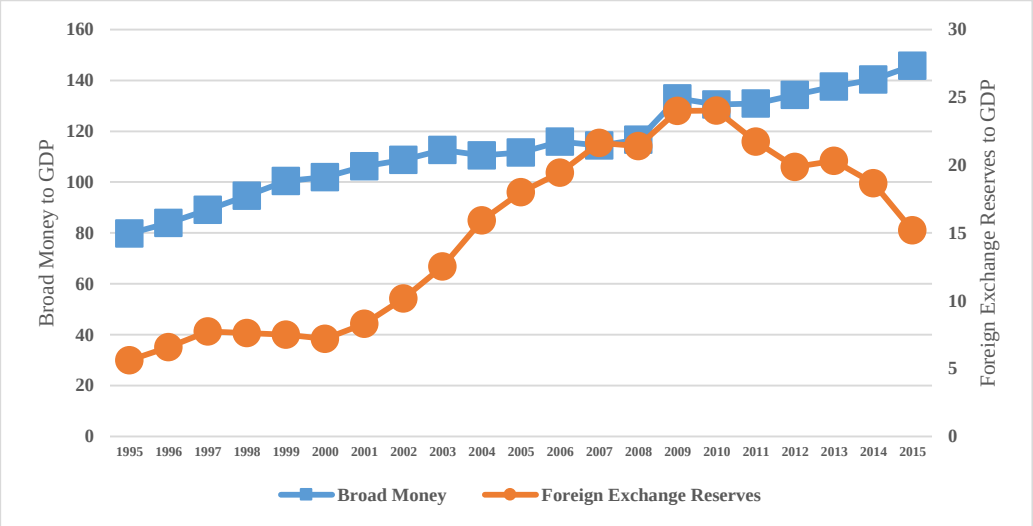


Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

As for China, due to the financial sector economic environment similarity has contributed to a lower value average for the OCA index in total sector. While the mean ratio of broad money to GDP between the United States and China showed a continuous increase, an average of foreign exchange reserves to GDP ratio between the two countries showed an increasing trend as well until 2010 while decreased afterward. A low value of the OCA index in the financial sector for Hong Kong can also be explained through continuously increased value in the average ratio of broad money to GDP and foreign exchange reserves to GDP between the United States and Hong Kong.

Figure 5.1.6

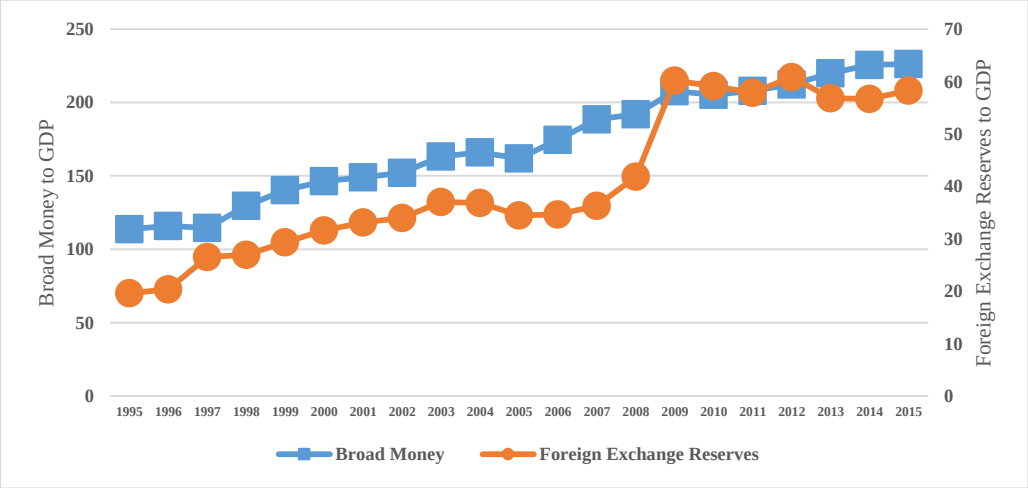
Average Ratio on Broad Money to GDP and Foreign Exchange Reserves to GDP between United States and China[32]



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

Figure 5.1.7

Average Ratio on Broad Money to GDP and Foreign Exchange Reserves to GDP between United States and Hong Kong



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

[32] China had continuous increase in foreign exchange reserves till 2013 while average of foreign exchange reserves to GDP declined since 2010 since China's GDP growth surpassed the growth in foreign exchange reserves

Vietnam was the country showing a drastic decrease in the average value of the OCA index vis-a-vis the United States. This is mainly due to the continuous increase in openness of trade and trade linkages with the United States. Since 1986, Vietnam has sought foreign direct investment in factories that produces manufactured goods while joined the World Trade Organization(2007) which triggered further openness to trade. As of starting the negotiation regarding Trans-Pacific Strategic Economic Partnership(TPP) in 2008, Vietnam has become a country known to facilitate export as their main engine for economic growth.

Figure 5.1.8

OCA Index of Vietnam vis-a-vis United States

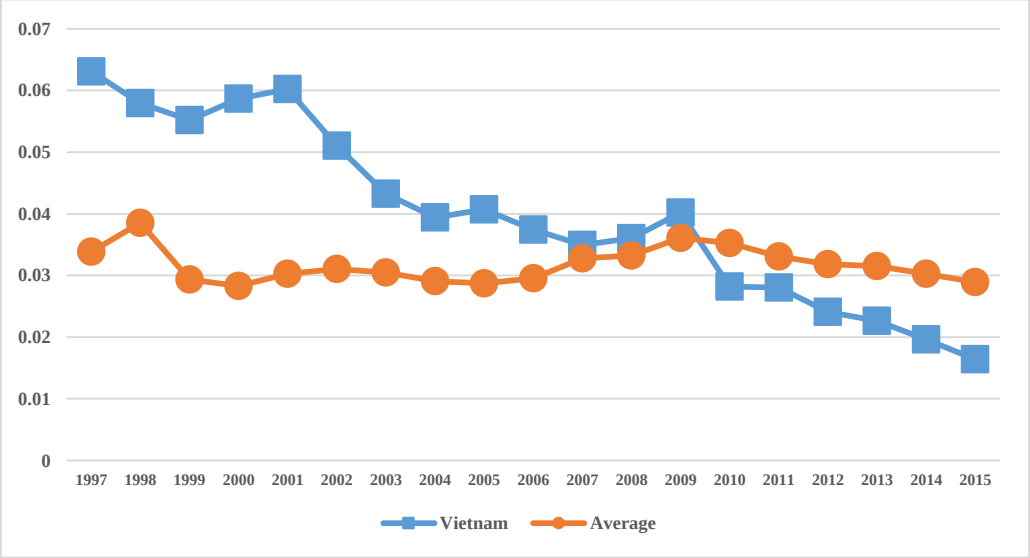
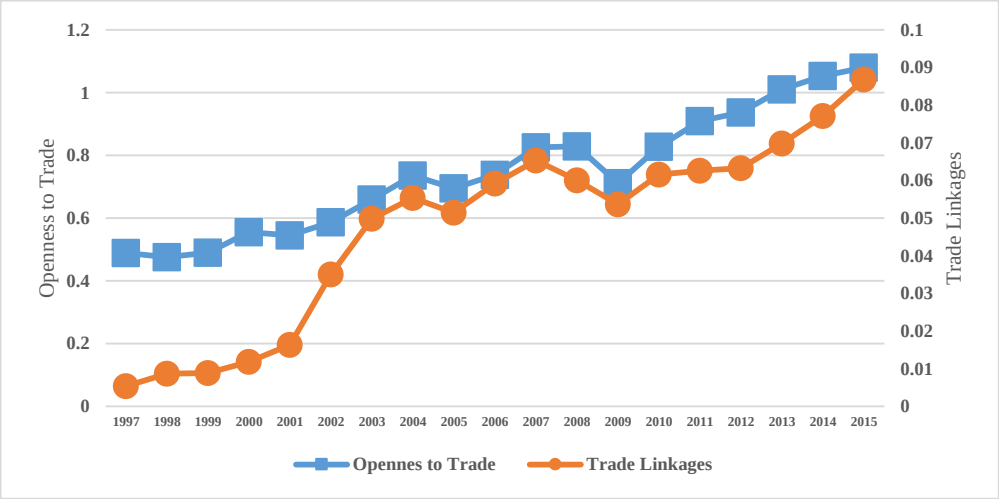


Figure 5.1.9

Openness to Trade and Trade Linkage between United States and Vietnam

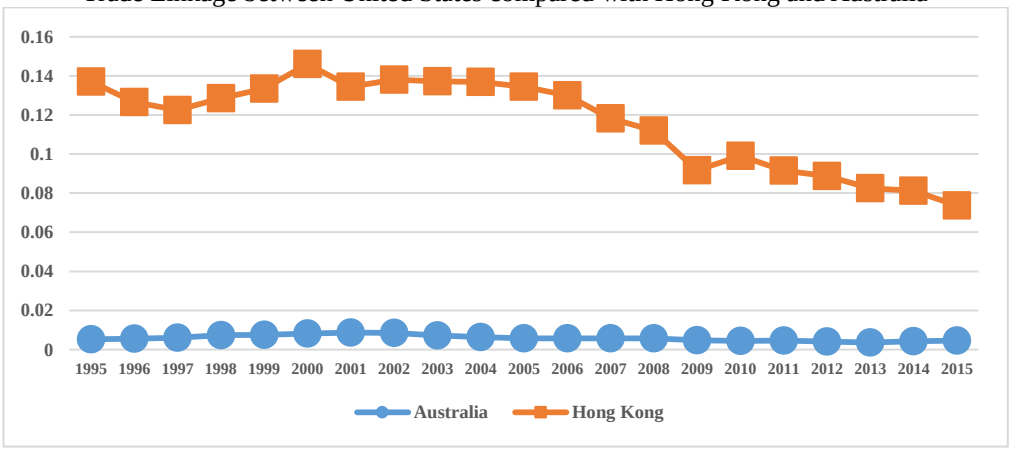


Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

The OCA index of Australia versus the United States recorded the highest in all 3 sectors. As it is shown from the figure, unlike other East Asia countries, Australia showed no correlation in the OCA index versus the United States. Such results are attributed due to the high gap in the degree of trade linkages with the United States.

Figure 5.1.10

Trade Linkage between United States compared with Hong Kong and Australia



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

5.2 China

I have estimated coefficients for China and its 10 leading trading partners[33] over the period of 1995 to 2015. The results of the regression are as follows (t-statistics are in the parentheses):

$$SD(\boldsymbol{e}_{ij}) = 0.384 + 0.001*\mathbf{ABS}(\blacktriangle \boldsymbol{y}_{\boldsymbol{i}} - \blacktriangle \boldsymbol{y}_{\boldsymbol{j}}) + 0.001*\boldsymbol{DISS}_{ij} - 0.110*\boldsymbol{TRADE}_{ij}$$
$$(2.57) \quad (1.82) \qquad\qquad (0.17) \qquad (-3.23)$$
$$+ 0.003*\boldsymbol{SIZE}_{ij} + 0.003*\boldsymbol{OPEN}_{ij} - 0.000*\boldsymbol{LL}_{ij} + 0.000*\boldsymbol{BD}_{ij}$$
$$(0.80) \qquad (0.17) \qquad (-0.01) \qquad (0.89)$$
$$- 0.000*\boldsymbol{DC}_{ij} - 0.001*\boldsymbol{FER}_{ij}$$
$$(-2.88) \qquad (-0.48)$$
$$N = 210, \ R^2 = 0.45, \text{S.E} = 0.029$$

From independent variables of asymmetric disturbance to output, openness to trade, trade linkages and domestic credit to GDP showed coefficient being significant at 1% probability level while average on broad money to GDP showed coefficient being significant at 10% probability level.

Next, I have run the regression for China with countries in East Asia using the same method as above. The period used is the same as the above equation, from 1995 to 2015. Based on the regression, I estimated coefficients and values of the independent

[33] Countries include Germany, United Kingdom, Hong Kong, India, Japan, Korea, Netherlands, Singapore, United States and Germany

variables from 1995 to 2015 to predict the dependent variable[34] of ASEAN+3[35], Hong Kong and Australia for the case of China as the common external peg.

$$SD(\boldsymbol{e}_{ij}) = 0.245 + 0.003*\mathbf{ABS}(\blacktriangle \boldsymbol{y}_i - \blacktriangle \boldsymbol{y}_j) + 0.001*\boldsymbol{DISS}_{ij} - 0.000*\boldsymbol{TRADE}_{ij}$$
$$(1.39) \quad (4.18) \qquad\qquad (0.14) \qquad (-1.50)$$
$$+ 0.017*\boldsymbol{SIZE}_{ij} - 0.000*\boldsymbol{OPEN}_{ij} - 0.001*\boldsymbol{LL}_{ij} + 0.000*\boldsymbol{BD}_{ij}$$
$$(1.71) \qquad (-0.00) \qquad (-2.45) \qquad (0.20)$$
$$- 0.003*\boldsymbol{DC}_{ij} - 0.000*\boldsymbol{FER}_{ij}$$
$$(-1.39) \qquad (-1.03)$$

N = 208[36], R^2 = 0.22, S.E = 0.045

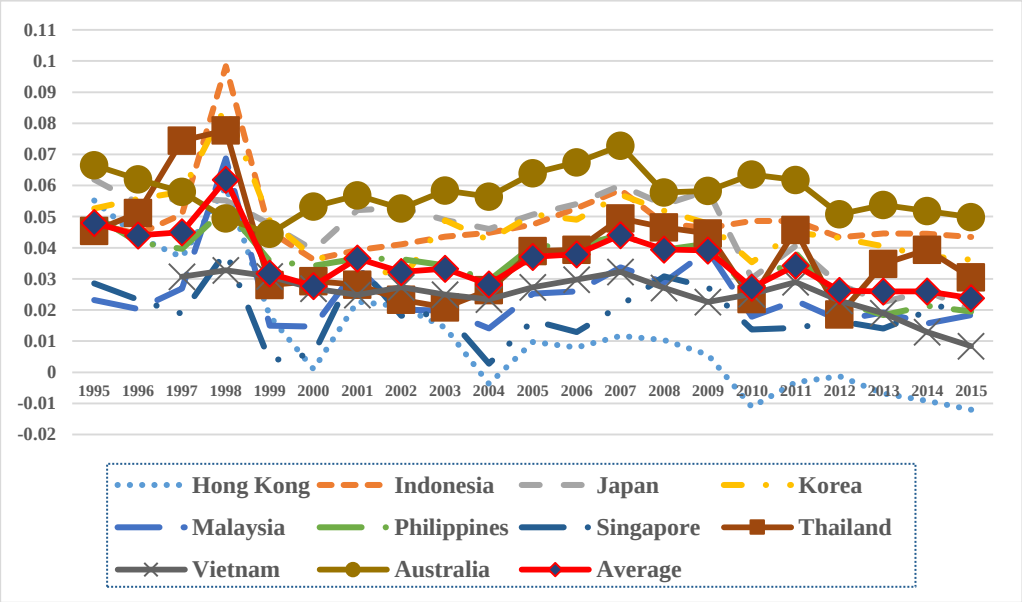
From independent variables of asymmetric disturbance to output and broad money to GDP showed coefficient being significant at 1% probability level while the economic size and foreign exchange reserves showed coefficient being significant at 10% probability level.

The difference in results from the two groups of 10 leading trading partners and that with East Asian countries was the degree of openness to trade where countries in East Asia with a higher degree of trade openness have less variation on exchange rate volatility while groups of top 10 leading trading partners showed the opposite result.

The figures of the OCA index versus China with East Asian countries in the total sector, the trade and financial sectors are shown on the bottom figures.

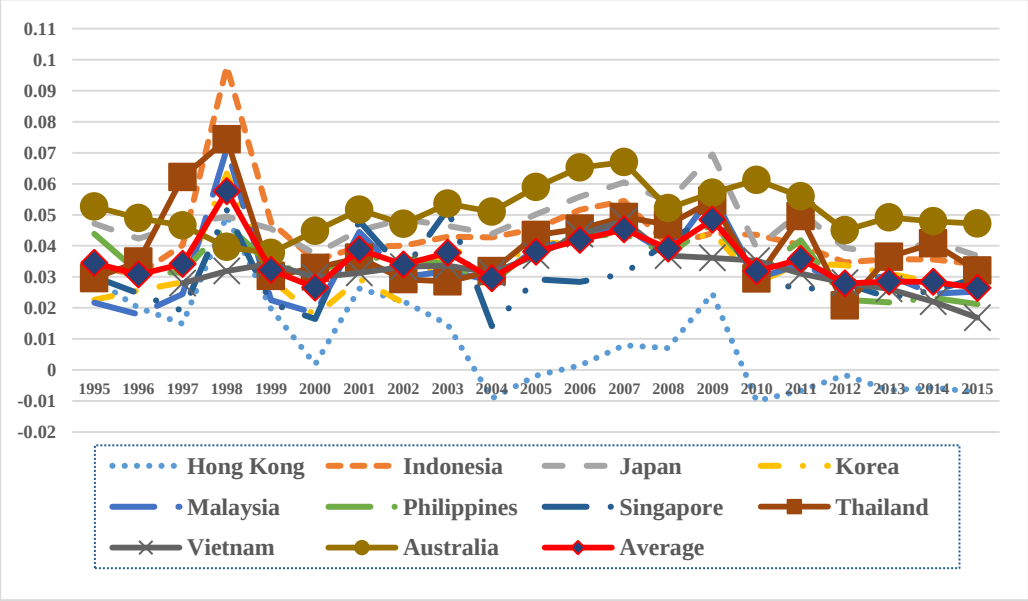
[34] Dependent variable, here, is the predicted level of exchange rate volatility. This is also the proxy for 'OCA Index', which the lower values indicates that countries concerned would be beneficial in forming as optimum currency area
[35] Cambodia, Lao PDR, Myanmar and Brunei were excluded from the analysis
[36] Vietnam was excluded for 1995 and 1996 data in trade sector

Figure 5.2.1
OCA Index versus China in Total Sector



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

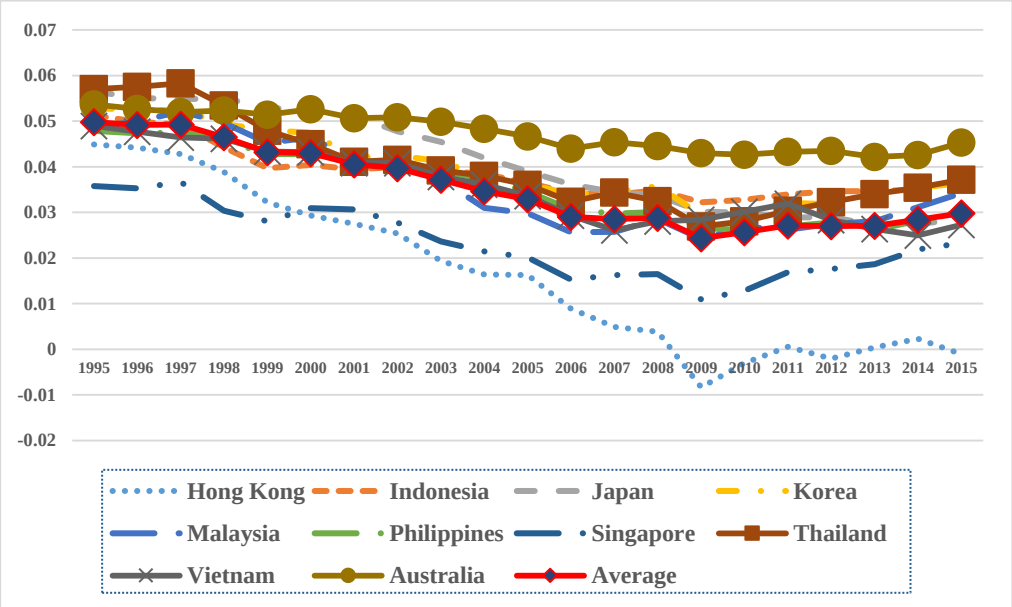
Figure 5.2.2
OCA Index versus China in Trade Sector



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

Figure 5.2.3

OCA Index versus China in Financial Sector



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

The overall average value of the OCA index vis-a-vis China showed the lowest compared to the other two candidates in forming a currency union with East Asian countries. Similar to the case from the United States, an average value of OCA index increased in both 1997 Asian financial crisis and 2008 global financial crisis while continuously decreased from the year 2011 showing East Asian countries economy have moved more suitable conditions to adopt Chinese official currency as their external peg.

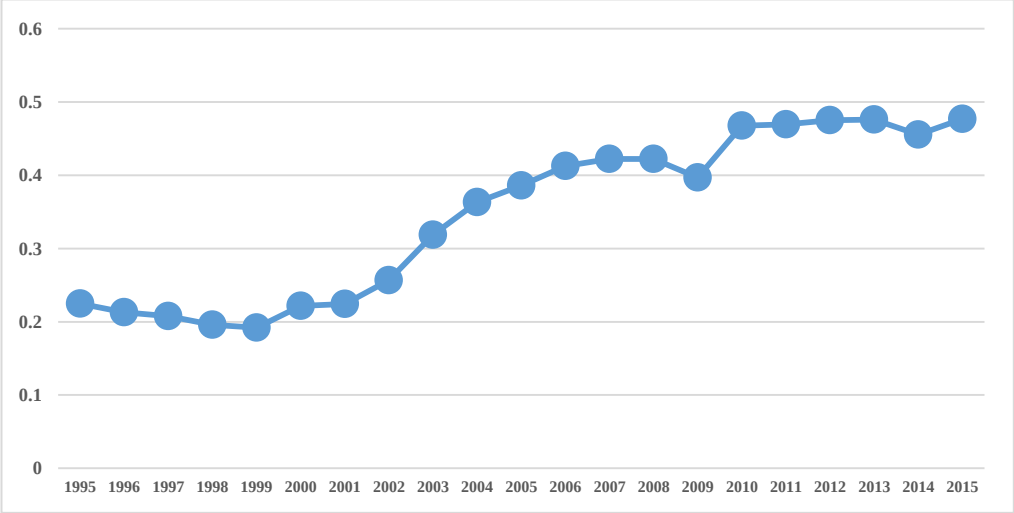
The country with the lowest value of the OCA index with China was Hong Kong while for countries that might benefit the least from pegging the currency with China was Australia and Indonesia. Although Japan showed a high value of the OCA

index in the trade sector, it was rather offset due to the high degree of developments in the financial sector.

Hong Kong was not the country with the lowest value of the OCA index in the total sector, which was the 3rd highest in 1995. However, except for the 1997 Asian financial crisis, mostly showed a decreasing trend. This is mainly due to a continuous increase in trade linkages with China while improvement made in the ratio of broad money to GDP and foreign exchange reserves to GDP in both countries. The reason for maintaining a high degree of average ratio on liability liquidity and accumulation on foreign exchange reserves was due to continuous efforts made by the Hong Kong government to defend its Hong Kong dollar's peg to the US currency.

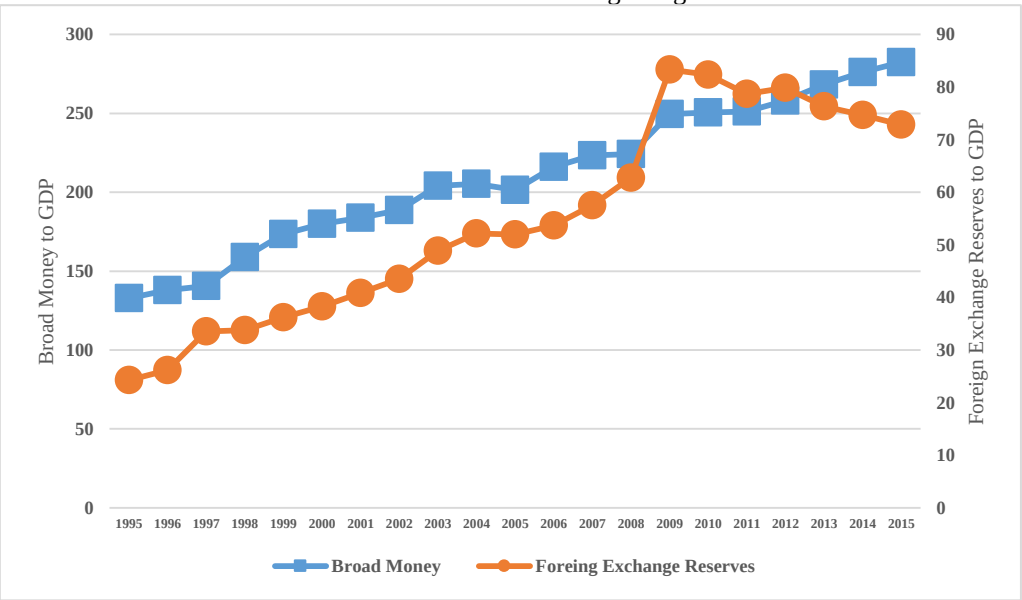
Figure 5.2.4

Trade Linkage between China and Hong Kong



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

Figure 5.2.5
Average Ratio on Broad Money to GDP and Foreign Exchange Reserves to GDP between China and Hong Kong

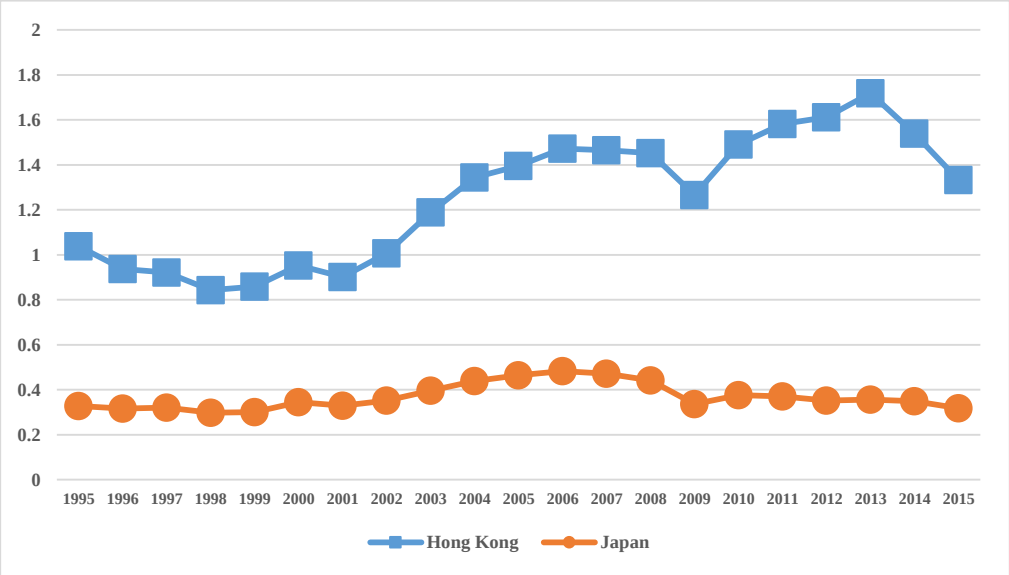


Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

As for Japan, the OCA index versus China was the 2nd highest among 10 countries concerned in 1995. However, it continuously decreased throughout the years and the value of OCA index became below average. In terms of the trade sector, the OCA index remained 2nd highest in 2015 mainly due to a low degree in openness to trade and trade linkage with China which was attributed by shrinking domestic markets in Japan. It showed a huge difference in both values comparing with Hong Kong.

Figure 5.2.6

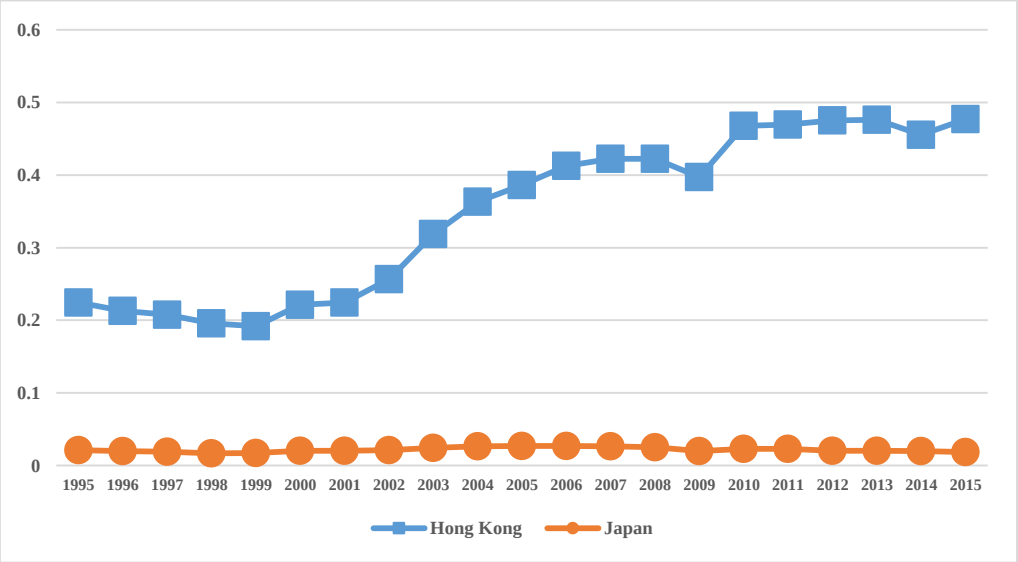
Openness to Trade between China compared with Hong Kong and Japan



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

Figure 5.2.7

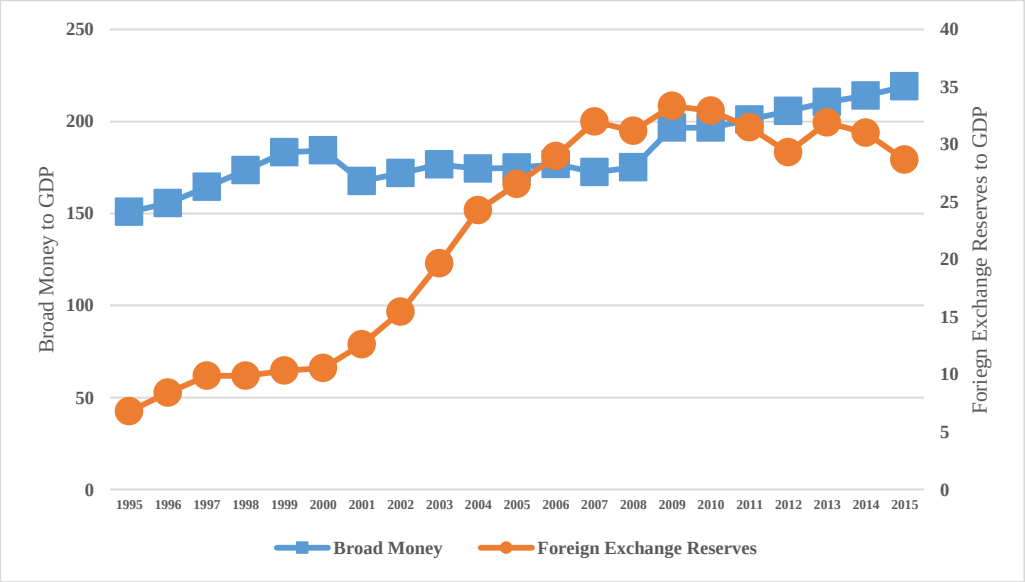
Trade Linkage between China compared with Hong Kong and Japan



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

However, the value of the OCA index in the financial sector showed a continuous decreasing trend. This is mainly due to the high average ratio in broad money to GDP and the increasing average ratio of foreign exchange reserves between China and Japan.

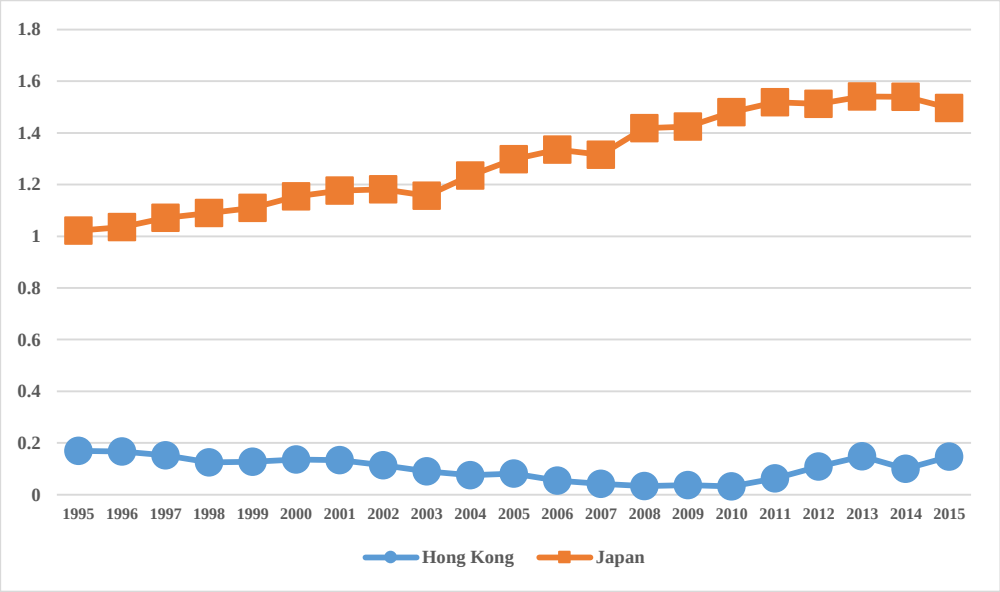
Figure 5.2.8
Average Ratio on Broad Money to GDP and Foreign Exchange Reserve to GDP between China and Japan



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

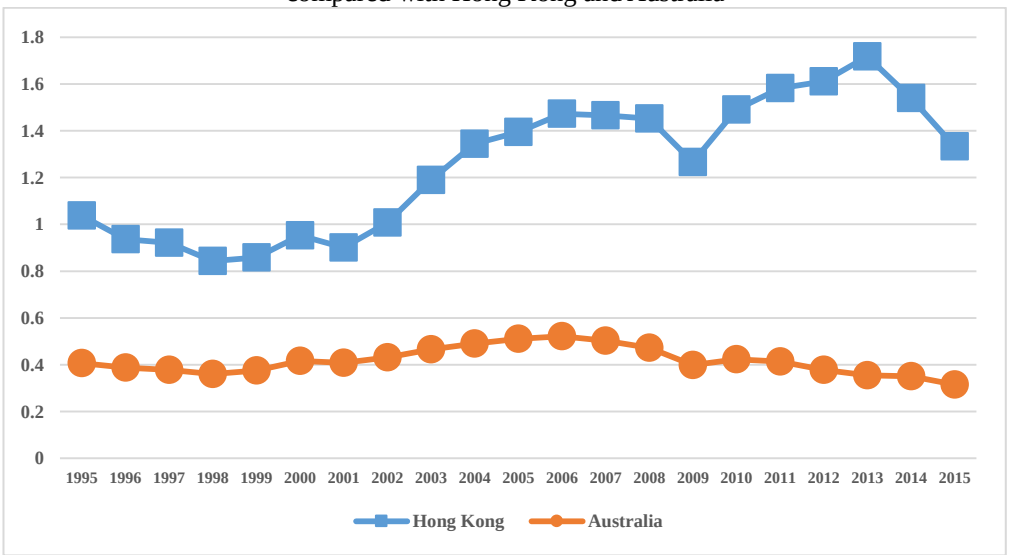
Australia showed the highest value in the OCA index versus China in all three sectors. As for the trade sector, the value on dissimilarity composition to export, openness to trade and trade linkage versus China was very low compared to that of Hong Kong. As China's industrial structure has changed from urbanization and basic manufactured goods to domestic consumption and more complexed goods and services, the demand for natural resources from Australia became much smaller.

Figure 5.2.9
Dissimilarity Composition to Export between China
Compared with Hong Kong and Australia



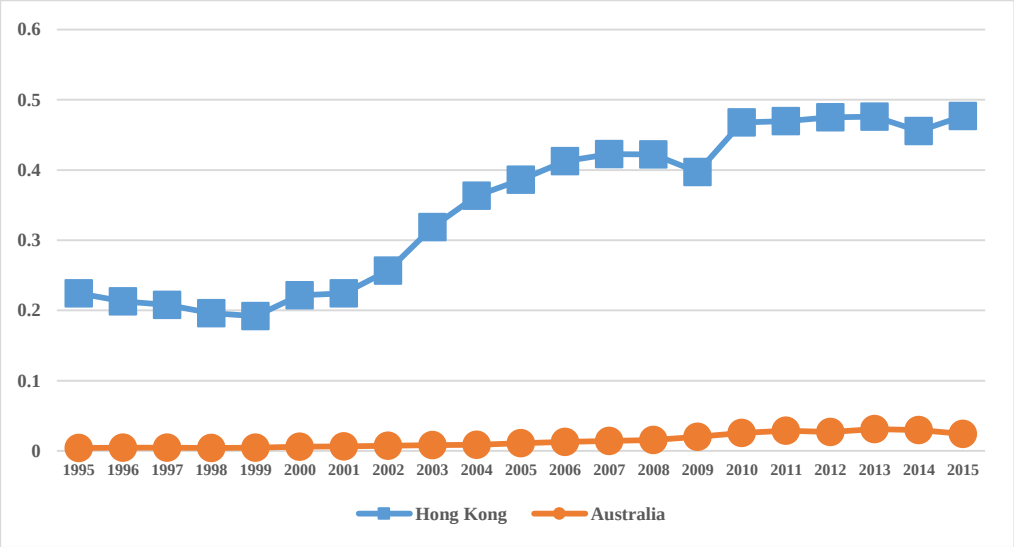
Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

Figure 5.2.10
Openness to Trade between China
compared with Hong Kong and Australia



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

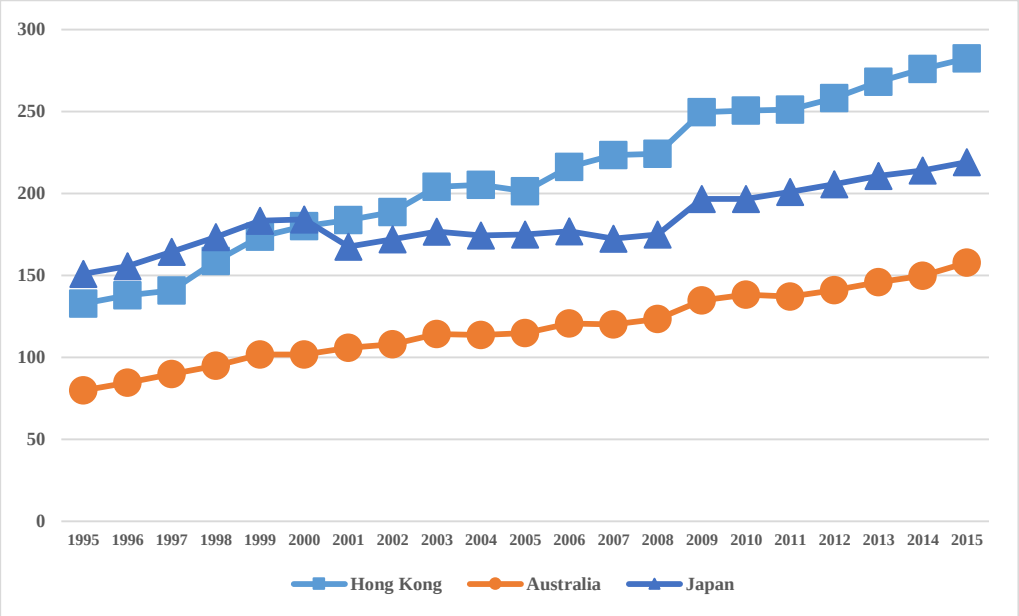
Figure 5.2.11
Trade Linkage between China
compared with Hong Kong and Australia



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

In the financial sector, the value of the OCA index versus China also remained highest since it had all financial sector independent variables with low average values compared to other countries concerned. For example on the average ratio for broad money to GDP, it shows a slight positive trend as time progresses while value difference between the East Asian countries remained high.

Figure 5.2.12
Average Ratio on Broad Money to GDP between China compared with Hong Kong, Japan and Australia



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

5.3 Japan

I have estimated coefficients for Japan and its 10 leading trading partners[37] over the period of 1995 to 2015. The results of the regression are as follows (t-statistics are in the parentheses):

$$SD(\boldsymbol{e}_{ij}) = 0.096 + 0.003*\mathbf{ABS}(\blacktriangle \boldsymbol{y}_i - \blacktriangle \boldsymbol{y}_j) + 0.010*\boldsymbol{DISS}_{ij} - 0.567*\boldsymbol{TRADE}_{ij}$$
$$(0.80) \quad (3.33) \qquad\qquad (1.48) \qquad (-1.73)$$
$$-0.004*\boldsymbol{SIZE}_{ij} + 0.044*\boldsymbol{OPEN}_{ij} - 0.000*\boldsymbol{LL}_{ij} + 0.000*\boldsymbol{BD}_{ij}$$
$$(-1.18) \qquad (0.11) \qquad (-0.59) \qquad (0.40)$$
$$+0.000*\boldsymbol{DC}_{ij} - 0.000*\boldsymbol{FER}_{ij}$$
$$(3.21) \qquad (-2.67)$$
$$N = 210, \ R^2 = 0.20, \text{S.E} = 0.032$$

From independent variables of asymmetric disturbance to output, openness to trade, trade linkages, domestic credit to GDP and foreign exchange reserves showed coefficient being significant at 1% probability level.

Next, I have run the regression for Japan with countries in East Asia using the same method as above. The period used is the same as the above equation, from 1995 to 2015. Based on the regression, I estimated the coefficients and values of the independent variables from 1995 to 2015 to predict the dependent variable[38] of ASEAN+3[39] and Australia for the case of Japan as the common external peg.

[37] Countries include Australia, China, Germany, Hong Kong, Indonesia, South Korea, Singapore, Thailand, United States and Vietnam

[38] Dependent variable, here, is the predicted level of exchange rate volatility. This is also the proxy for 'OCA Index', which the lower values indicates that countries concerned would be beneficial in forming as optimum currency area

[39] Cambodia, Lao PDR, Myanmar and Brunei were excluded from the analysis

$$SD(\boldsymbol{e}_{ij}) = 0.027 + 0.002*\mathbf{ABS}(\blacktriangle \boldsymbol{y}_i - \blacktriangle \boldsymbol{y}_j) + 0.002*\boldsymbol{DISS}_{ij} - 2.49*\boldsymbol{TRADE}_{ij}$$
$$(0.14) \quad (2.14) \qquad\qquad (0.42) \qquad (-0.78)$$
$$+ 0.000*\boldsymbol{SIZE}_{ij} + 0.013*\boldsymbol{OPEN}_{ij} - 0.001*\boldsymbol{LL}_{ij} + 0.000*\boldsymbol{BD}_{ij}$$
$$(0.01) \qquad (0.86) \qquad (-2.07) \qquad (1.75)$$
$$+ 0.000*\boldsymbol{DC}_{ij} - 0.000*\boldsymbol{FER}_{ij}$$
$$(2.77) \qquad (-2.81)$$

N = 208[40], R^2 = 0.17, S.E = 0.039

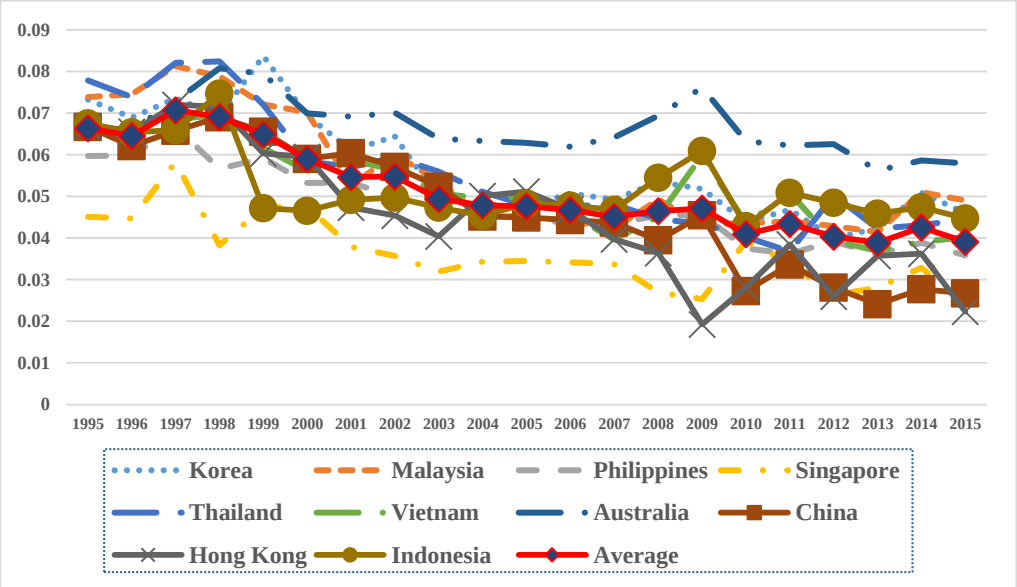
From independent variables of domestic credit to GDP and foreign exchange reserves to GDP showed coefficient being significant at 5% probability while asymmetric disturbance to GDP, bank deposit to GDP and broad money to GDP showed coefficient being significant at 10% probability level.

Most of the results from the two groups of 10 leading trading partners and that with East Asian countries were similar while opposite in economic size where countries in East Asia with larger economic size tends to have more variation on exchange rate volatility while groups of top 10 leading trading partners showed the opposite result.[41]

The figures of the OCA index versus Japan with East Asian countries in the total sector, the trade and financial sectors are shown on the bottom figures.

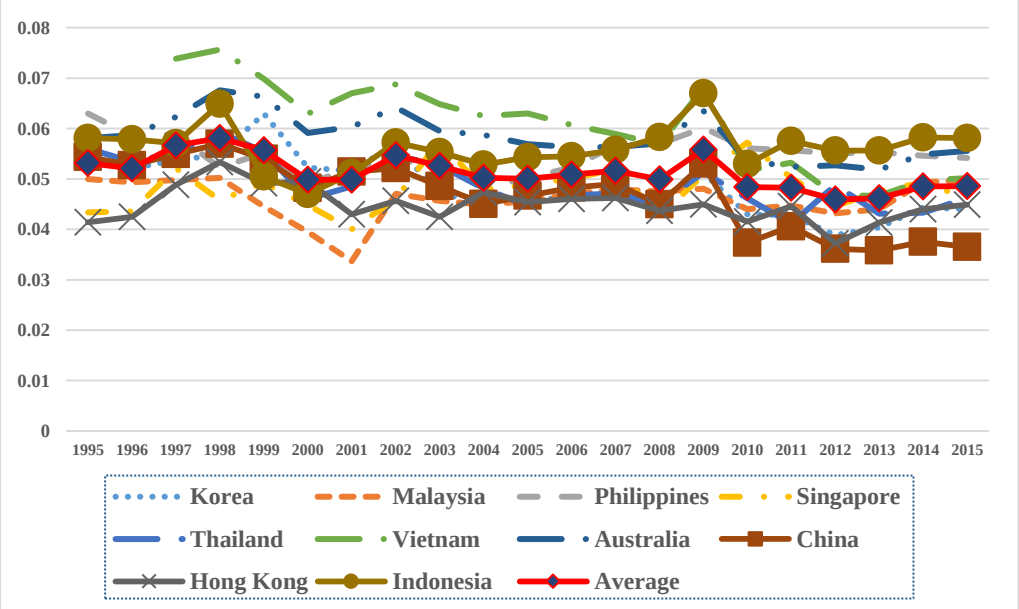
[40] Vietnam was excluded for 1995 and 1996 data in trade sector
[41] However, sign of coefficient for 'economic size' showed negative from 'Trade Sector' regression

Figure 5.3.1
OCA Index versus Japan in Total Sector



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

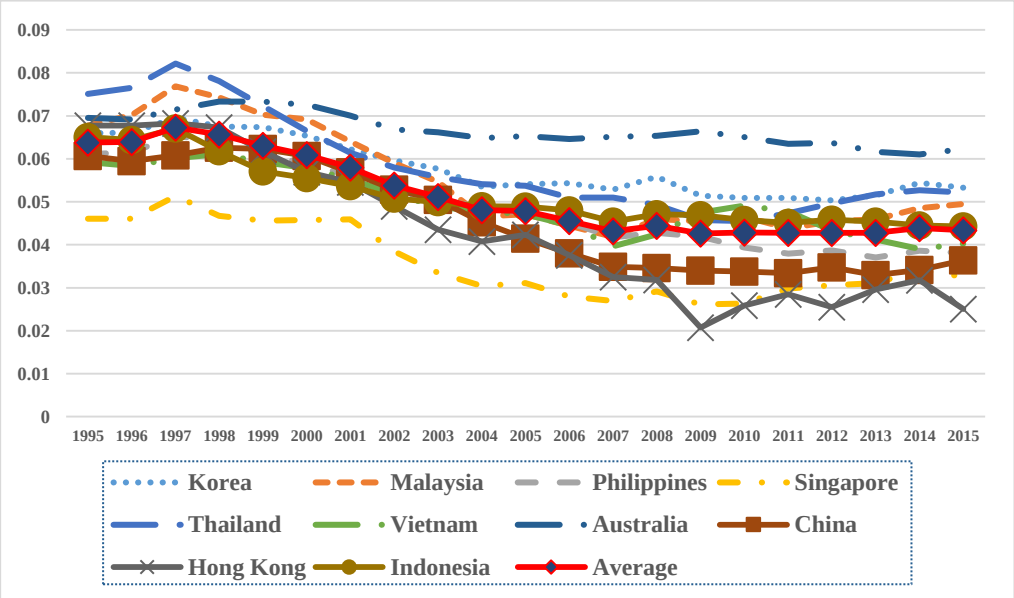
Figure 5.3.2
OCA Index versus Japan in Trade Sector



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

Figure 5.3.3

OCA Index versus Japan in Financial Sector



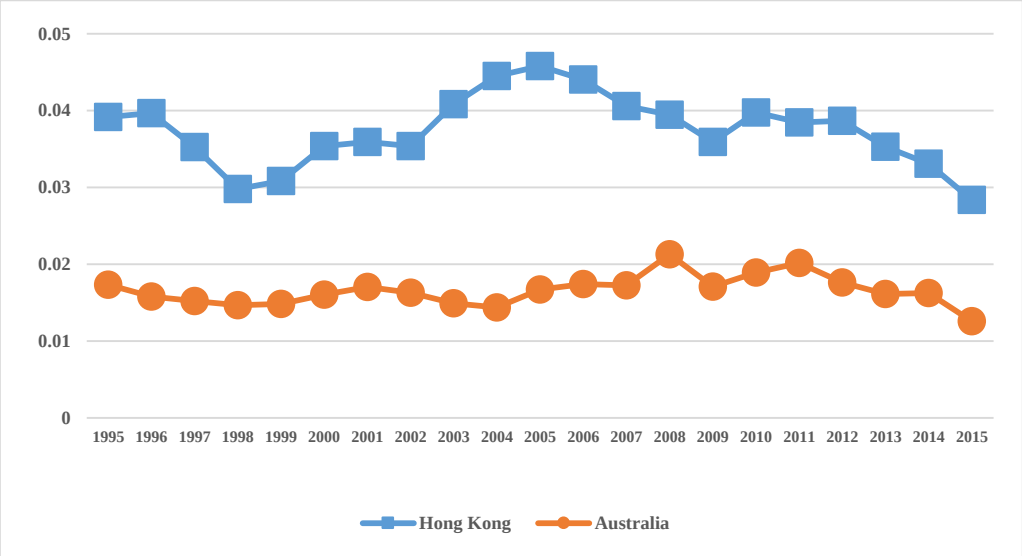
Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

The average value of the OCA index vis-a-vis Japan with other East Asian countries showed a general decreasing trend over the 21 years. The value of the OCA index showed, as like the case in the United States and China, a sudden increase during the 1997 Asian financial crisis and the 2008 global financial crisis while value has continuously decreased over time. However, the value of the OCA index was almost twice as high as to that of the United States and China. Singapore, China and Hong Kong were the countries that showed lower value in the OCA index versus Japan compared to other countries while Australia showed the highest.

As for Hong Kong, the reasons for the low average value of OCA index versus Japan is attributed from both trade and financial sector. As in the trade sector, a

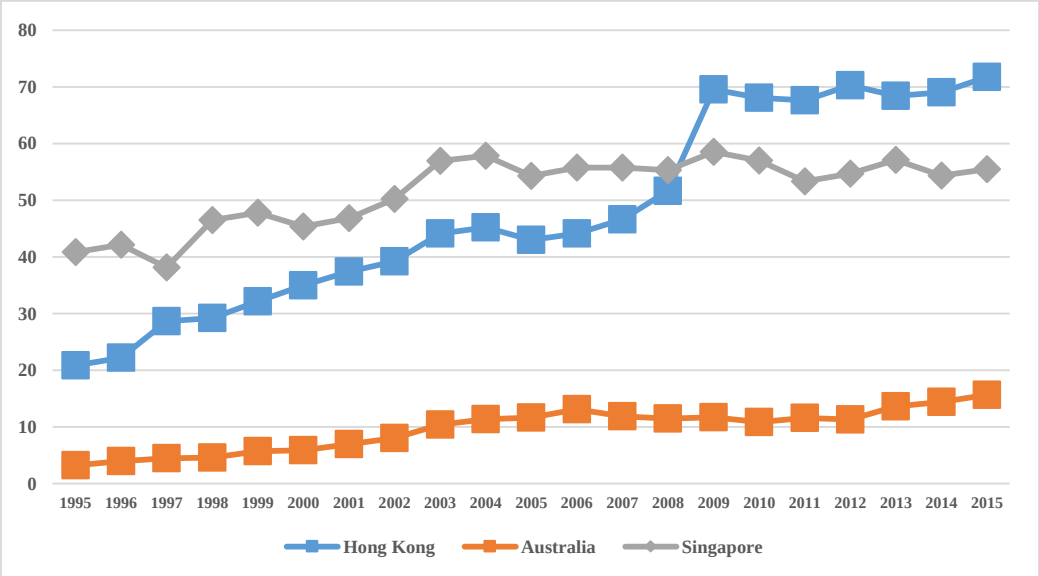
high degree in trade linkages between Japan was the main reason of showing the low value while the high value in the average of broad money to GDP and foreign exchange reserves to GDP between Japan were the main contribution in the financial sector to have a low value of OCA index. The degree of trade linkages differentials with Japan was substantial between Hong Kong and Australia resulting high difference in the value of OCA index in the trade sector. In terms of the financial sector, comparing the average value of foreign exchange reserves to GDP between Japan, Hong Kong and Singapore showed an increasing trend while Australia had larger value differentials in that category than that to the other two countries. High average ratio of foreign exchange reserves to GDP was the main contributions to have a low value of OCA index versus Japan for Singapore in the financial sector. High degree differential was also shown from the average ratio on broad money to GDP between Japan, Hong Kong and Australia.

Figure 5.3.4
Trade Linkages between Japan
compared with Hong Kong and Australia



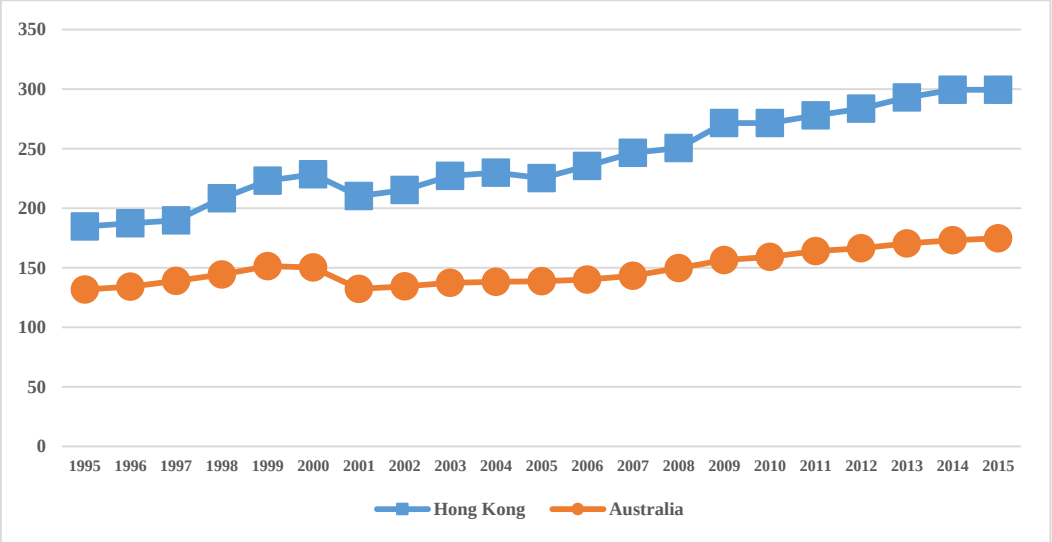
Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

Figure 5.3.5
Average Ratio on Foreign Exchange Reserve to GDP between Japan
compared with Hong Kong, Singapore and Australia



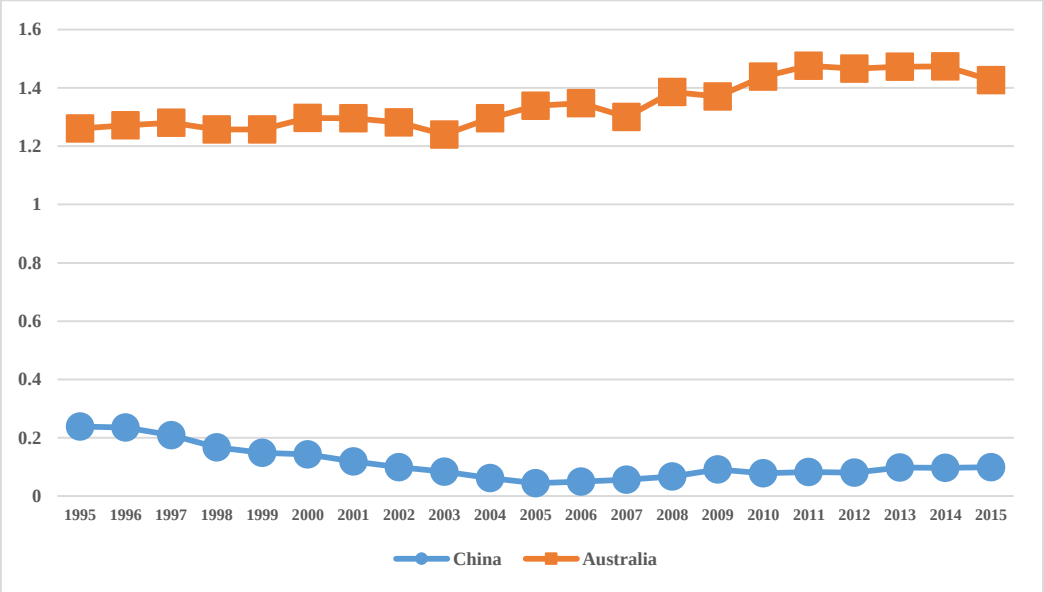
Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

Figure 5.3.6
Average Ratio on Broad Money to GDP between Japan compared with Hong Kong and Australia



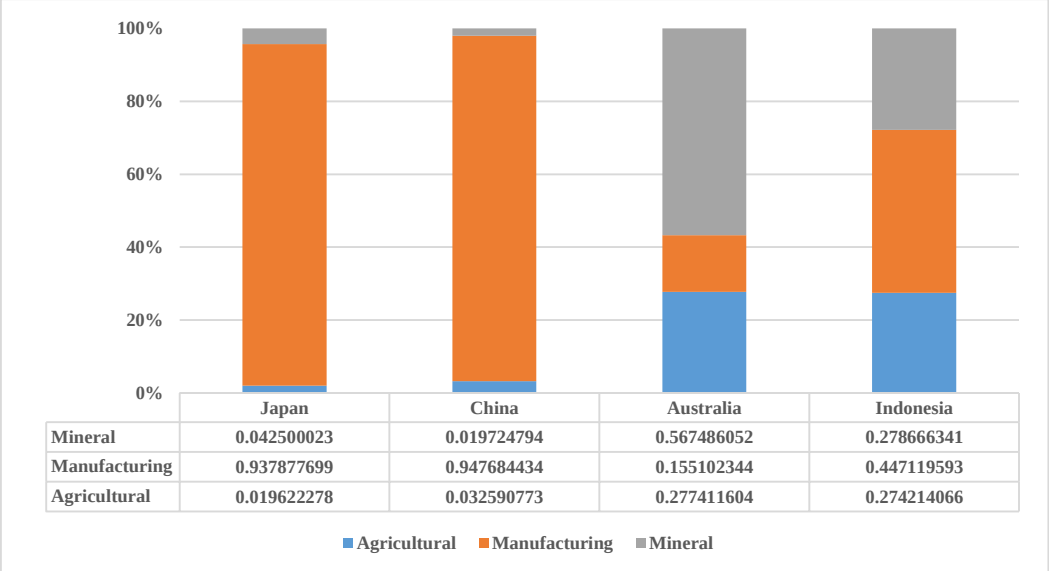
As for China, it showed that the main reason for a low value of the OCA index versus Japan was contributed from the trade sector, especially of having a lesser dissimilarity of trade structure with Japan. As shown from the bottom figure, compared to that of Australia, China showed a more similar structure in export products while Australia and Indonesia, which had a high value of the OCA index in the trade sector versus Japan, showed higher differential.

Figure 5.3.7
Dissimilarity Composition to Export between Japan compared with China and Australia



Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

Figure 5.3.8
Exports Components of Japan, China, Australia and Indonesia in 2015



	Japan	China	Australia	Indonesia
Mineral	0.042500023	0.019724794	0.567486052	0.278666341
Manufacturing	0.937877699	0.947684434	0.155102344	0.447119593
Agricultural	0.019622278	0.032590773	0.277411604	0.274214066

Source: World Bank, OECD, UN Comtrade, Global Financial Development data, IMF and IFS

VI Conclusion

The study tried to analyze whether East Asia is moving toward to become an optimum currency area by using predicted level of exchange rate variability based on the model used in Eichengreen and Bayoumi(1996) paper. Using the OCA index with variables concerned in trade and financial sector, it analyzes how variables in those two sectors affect exchange rate volatility on 11 East Asian countries from year 1995 to 2015.

The findings from the analysis showed that first, it is not clear to conclude whether East Asian countries are ready to form currency union at the current stage while it has shown that East Asian countries are moving toward more favorable conditions in forming a common currency zone. Overall average of the OCA index versus the United States, China and Japan showed a declining trend, meaning East Asian countries would more benefit from than that of the past by forming a currency union with those three countries being the anchor currency countries. By having a lower value of the OCA index, meaning having less variation in exchange rate volatility, would be more beneficial for countries than that to the cost of losing their independent monetary policy when forming the currency union.

In concerning which currency to become common external peg, the OCA index versus the United States and China were more favorable candidates than that of Japan. As though the value of the OCA index versus Japan was most decreased in the total sector, the value was almost twice as high as that of the United States and China in

2015. This was mainly due to a relatively high degree of environmental dissimilarity on the trade sector with other East Asian countries concerned than that to the United States and China.

By analyzing the OCA index in terms of sectors, the value of the OCA index from the trade sector showed a continuous declining trend from 2010 for the United States and China while it was opposite in the financial sector that increased from 2009. As for Japan, the value of the OCA index in the trade sector did not decrease since 2010 as well as in the financial sector from 2009.

As for the value of the OCA index in the financial sector, unlike the United States and China, Japan rather showed a decreasing trend over 21 years, especially from the year 2009. However, it showed that contribution from the financial sector to total OCA index was rather insignificant as the trend of the OCA index from the trade sector was more similar to the trend of the total sector

VII Limitations and Further Research

Paper from Bayoumi and Eichengreen(1996) used 4 OCA criteria of difference in real output between pair countries, the dissimilarity of the composition of exports of the pair trade partner, amount of bilateral trade and economic size as for their OCA index analysis. However, I have additionally included another 5 more variables, including trade openness, bank deposit to GDP, broad money to GDP, foreign exchange reserves to GDP and domestic credit to GDP as to see the effect of degree of financial integration on exchange rate volatility while the results were not so significant. I believe the results would have been more significant if bilateral financial data, such as bilateral FDI, would have led to have more significant results from this analysis while it was difficult to include in this paper due to difficult data accessibility. Analyzing the OCA index with the inclusion of bilateral financial factors would make more significant results and valuable study.

Also, it would be meaningful study to find country specific variables that affects exchange rate volatility on each of the member countries. As countries with different economic factors would have different causes affecting exchange rate, by looking over the correlation of economic variables affecting exchange rate volatility based on specific countries can also be valuable study.

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APPENDIX

Appendix I

United States OLS Regression Full Dataset

Dependent Variable			
Bilateral Exchange Rate Volatility	(1) Total	(2) Trade	(3) Finance
Asymmetric Disturbance to Output	0.0037282*** (4.04)	0.0016624* (1.90)	
Dissimilarity of the Commodity Composition of Export	0.0069849 (0.83)	0.0108987 (1.23)	
Trade Linkages	-0.1798899 (-1.53)	-0.3668871*** (-4.23)	
Size	-0.0034496 (-0.46)	-0.0083021** (-2.19)	
Openness of the Economy	-0.0011591 (-0.08)		
Domestic Credit to GDP	0.0003805** (-2.12)		0.0003973** (2.32)
Bank Deposit to GDP	0.0008114*** (5.21)		0.0005764*** (4.13)
Broad Money to GDP	-0.0009777*** (-4.23)		-0.0008753*** (-4.76)
Foreign Exchange Reserves to GDP	-0.0006194* (-1.87)		-0.0007188*** (-3.58)
Observations	229	229	231
R-Squared	0.37	0.25	0.31

Notes:

(1) t-statistics are in the parentheses
(2) ***p<0.001, **p<0.01, *p<0.05
(3) Vietnam was excluded for 1995 and 1996 data in Trade Sector

Appendix II

China OLS Regression Full Dataset

Dependent Variable			
Bilateral Exchange Rate Volatility	(1) Total	(2) Trade	(3) Finance
Asymmetric Disturbance to Output	0.0035277*** (4.18)	0.0035565*** (4.60)	
Dissimilarity of the Commodity Composition of Export	0.0009942 (0.14)	0.0104435 (1.65)	
Trade Linkages	-0.000406 (- 1.50)	-0.0882384*** (-3.51)	
Size	0.0117101* (1.71)	0.0002653 (0.09)	
Openness of the Economy	-0.0000598 (-0.00)		
Domestic Credit to GDP	0.0002889 (1.39)		0.0003139 (2.32)
Bank Deposit to GDP	0.0000386 (0.20)		0.0001545 (4.13)
Broad Money to GDP	-0.0006445*** (-2.45)		-0.0003887* (-4.76)
Foreign Exchange Reserves to GDP	-0.0003875* (-1.03)		-0.0004803** (-3.58)
Observations	208	208	210
R-Squared	0.22	0.16	0.11

Notes:

(1) t-statistics are in the parentheses
(2) ***p<0.001, **p<0.01, *p<0.05
(3) Vietnam was excluded for 1995 and 1996 data in Trade Sector

Appendix III

Japan OLS Regression Full Dataset

Dependent Variable			
Bilateral Exchange Rate Volatility	(1) Total	(2) Trade	(3) Finance
Asymmetric Disturbance to Output	0.0021563* (2.14)	0.0015031 (1.62)	
Dissimilarity of the Commodity Composition of Export	0.002571 (0.42)	0.0082318 (1.46)	
Trade Linkages	-0.2499896 (-0.78)	-0.506962* (-1.94)	
Size	0.000858 (0.01)	-0.011344* (-2.17)	
Openness of the Economy	0.0136825 (0.86)		
Domestic Credit to GDP	0.0004135** (2.77)		0.000387** (2.79)
Bank Deposit to GDP	0.0003138* (1.75)		0.0002225 (1.66)
Broad Money to GDP	-0.0004423* (-2.07)		-0.0003077* (-2.13)
Foreign Exchange Reserves to GDP	-0.0008545** (-2.81)		-0.0006859*** (-3.19)
Observations	208	208	210
R-Squared	0.37	0.25	0.31

Notes:

(1) t-statistics are in the parentheses
(2) ***p<0.001, **p<0.01, *p<0.05
(3) Vietnam was excluded for 1995 and 1996 data in Trade Sector

Appendix IV

OCA Index versus United States in Total Sector (1995-2015)

Year	Vietnam	Australia	China	Hong Kong	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Thailand	Average
1995		0.045299	0.03222	0.008508	0.051924	0.040893	0.056114	0.039427	0.030258	0.009214	0.056335	0.037019
1996		0.042412	0.022903	0.011743	0.046952	0.043933	0.046675	0.042026	0.029802	0.009186	0.047169	0.03428
1997	0.048133	0.046222	0.015881	0.014239	0.035018	0.056049	0.040287	0.034647	0.025486	0.014511	0.068787	0.036296
1998	0.039982	0.046946	0.010596	0.047697	0.092156	0.066405	0.068159	0.063252	0.041513	0.015543	0.082059	0.05221
1999	0.032159	0.049743	0.008475	0.012391	0.041167	0.06523	0.057086	0.019782	0.028651	-0.0006	0.034363	0.031677
2000	0.038095	0.049389	0.012018	0.009577	0.028735	0.048183	0.04736	0.033645	0.020831	0.014997	0.027892	0.030065
2001	0.044983	0.052842	0.021817	0.005024	0.038271	0.052571	0.030401	0.01638	0.029493	0.010055	0.035147	0.030635
2002	0.037119	0.056797	0.018769	-0.0012	0.039423	0.044732	0.037261	0.027094	0.027925	0.008126	0.042022	0.030734
2003	0.030485	0.051328	0.017428	-0.0061	0.040264	0.045011	0.02092	0.02417	0.033918	0.01361	0.042858	0.028536
2004	0.027707	0.053148	0.013197	0.011233	0.039348	0.045516	0.023124	0.018414	0.038797	0.02009	0.038261	0.029894
2005	0.029765	0.054617	0.015478	0.012609	0.044172	0.045359	0.021955	0.017438	0.03376	0.017935	0.032657	0.029613
2006	0.025995	0.056094	0.018814	0.006536	0.048559	0.044455	0.028502	0.020179	0.035906	0.023261	0.03764	0.031449
2007	0.019523	0.065864	0.030841	0.004854	0.055182	0.038386	0.032508	0.031683	0.04479	0.031537	0.045914	0.036462
2008	0.023412	0.070621	0.019136	0.000411	0.06064	0.038659	0.02785	0.03988	0.043095	0.01276	0.035216	0.033789
2009	0.031717	0.076109	0.02036	-0.01706	0.063958	0.04475	0.024807	0.023875	0.041896	0.011634	0.031548	0.032145
2010	0.012641	0.058474	0.006356	0.0007	0.05066	0.04023	0.028408	0.042324	0.044364	0.05232	0.042052	0.034411
2011	0.016341	0.055964	0.004149	-0.00139	0.051563	0.035276	0.020894	0.033969	0.030755	0.02534	0.024188	0.027004
2012	0.002994	0.05935	-0.00646	-0.01472	0.049034	0.032097	0.012121	0.03434	0.040851	0.015525	0.043679	0.024437
2013	0.002625	0.055504	-0.00544	-0.00545	0.051802	0.029963	0.028706	0.0377	0.0432	0.025529	0.036261	0.02731
2014	0.003661	0.050451	-0.00985	-0.00603	0.0465	0.037451	0.037625	0.043352	0.040408	0.02234	0.040465	0.027852
2015	0.006465	0.055518	-0.01491	-0.01055	0.044187	0.033026	0.033108	0.039019	0.037972	0.018786	0.034533	0.025196

Appendix V

OCA Index versus United States in Trade Sector (1995-2015)

Year	Vietnam	Australia	China	Hong Kong	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Thailand	Average
1995		0.050575	0.046126	-0.00056	0.052649	0.027286	0.044384	0.02732	0.039021	0.010352	0.043583	0.034074
1996		0.048478	0.042184	0.002765	0.04972	0.028307	0.039576	0.030776	0.035105	0.010082	0.038266	0.032526
1997	0.063062	0.049059	0.038408	0.00362	0.043912	0.031906	0.034663	0.024474	0.028261	0.01084	0.044333	0.033867
1998	0.057936	0.048193	0.035081	0.01777	0.067994	0.03501	0.046025	0.026756	0.030239	0.011383	0.047265	0.038514
1999	0.055166	0.048513	0.033613	0.002369	0.047443	0.033261	0.03947	0.006205	0.026575	0.002349	0.027925	0.029353
2000	0.058645	0.047936	0.034463	-2.1E-05	0.040566	0.026411	0.034416	0.014427	0.021518	0.008338	0.024732	0.028312
2001	0.060229	0.049374	0.039442	-0.00075	0.044201	0.025864	0.034141	0.011439	0.028531	0.010935	0.029477	0.030262
2002	0.05101	0.050945	0.037732	-0.00253	0.045471	0.027839	0.037972	0.017067	0.030205	0.012046	0.033664	0.031039
2003	0.043249	0.046522	0.035545	-0.00249	0.044905	0.027415	0.028923	0.015716	0.03395	0.026846	0.034805	0.030489
2004	0.039396	0.045602	0.032199	0.005172	0.04236	0.02779	0.029213	0.013869	0.036594	0.017685	0.030197	0.029098
2005	0.040702	0.045351	0.032999	0.004217	0.043932	0.027482	0.029296	0.010906	0.034629	0.019211	0.026888	0.028692
2006	0.037434	0.045587	0.034336	0.005201	0.045211	0.025339	0.031685	0.013783	0.034982	0.022674	0.028909	0.029558
2007	0.034956	0.047285	0.038951	0.009792	0.04795	0.023453	0.033649	0.023721	0.040202	0.027652	0.032692	0.032755
2008	0.036036	0.050026	0.036214	0.008668	0.050468	0.025376	0.032278	0.031973	0.040892	0.023021	0.030553	0.033228
2009	0.040203	0.051551	0.042432	0.012897	0.05215	0.03074	0.035184	0.027777	0.042468	0.028949	0.032784	0.036103
2010	0.028184	0.044381	0.033821	0.016108	0.044801	0.027969	0.033987	0.034576	0.043345	0.044081	0.036501	0.03525
2011	0.028053	0.043669	0.033957	0.017227	0.04606	0.028354	0.030413	0.034708	0.038335	0.033399	0.029837	0.033092
2012	0.024099	0.044336	0.029673	0.012777	0.044484	0.026254	0.026314	0.033702	0.043244	0.028661	0.036535	0.031825
2013	0.02266	0.0431	0.030104	0.015436	0.043665	0.02526	0.028019	0.033904	0.043632	0.030615	0.030173	0.031506
2014	0.019621	0.041836	0.027918	0.014645	0.040759	0.028399	0.026919	0.034353	0.040454	0.027496	0.030575	0.03027
2015	0.016397	0.04265	0.025926	0.016437	0.039508	0.026928	0.025424	0.031077	0.039934	0.026076	0.027883	0.028931

Appendix VI

OCA Index versus United States in Financial Sector (1995-2015)

Year	Vietnam	Australia	China	Hong Kong	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Thailand	Average
1995	0.036386	0.044249	0.019107	0.029997	0.039436	0.046717	0.043508	0.032994	0.035064	0.016771	0.046566	0.035527
1996	0.037011	0.045248	0.017944	0.031077	0.039935	0.04719	0.045341	0.036469	0.036532	0.018425	0.050086	0.036841
1997	0.03815	0.047282	0.016896	0.032122	0.041831	0.049477	0.048458	0.042262	0.03955	0.023598	0.053105	0.039339
1998	0.039311	0.049513	0.017354	0.028501	0.036254	0.051403	0.045292	0.041947	0.040866	0.014542	0.0492	0.037653
1999	0.036801	0.051439	0.017357	0.023012	0.034715	0.052378	0.046585	0.038709	0.039664	0.016646	0.045475	0.036616
2000	0.033482	0.051516	0.015925	0.016581	0.034311	0.048781	0.043808	0.039254	0.037952	0.01984	0.039792	0.034658
2001	0.032419	0.051825	0.014311	0.01961	0.036564	0.055273	0.032312	0.035074	0.038327	0.02175	0.038148	0.034147
2002	0.031023	0.051032	0.011702	0.014989	0.03655	0.045284	0.031066	0.033403	0.035997	0.017171	0.037413	0.031421
2003	0.030017	0.053849	0.011809	0.009575	0.040121	0.046702	0.034816	0.033021	0.039425	0.014998	0.03812	0.032041
2004	0.030685	0.055879	0.011217	0.009587	0.042972	0.046064	0.034106	0.027942	0.041172	0.016759	0.041274	0.032514
2005	0.030738	0.057491	0.007965	0.01423	0.04409	0.045849	0.034988	0.031303	0.041301	0.018968	0.042471	0.033581
2006	0.028317	0.058477	0.00499	0.006956	0.046083	0.047174	0.035334	0.029838	0.040058	0.016425	0.042138	0.032344
2007	0.020604	0.061535	0.006831	0.001034	0.046114	0.045262	0.035331	0.031208	0.039336	0.018958	0.044781	0.031909
2008	0.021427	0.057587	0.002759	-0.00023	0.044621	0.041305	0.032815	0.032938	0.037263	0.016158	0.038784	0.029584
2009	0.022305	0.059301	-0.00534	-0.0167	0.043527	0.038373	0.026114	0.028976	0.035553	0.010587	0.03279	0.025044
2010	0.023217	0.057476	-0.00324	-0.01033	0.044801	0.038517	0.029037	0.034008	0.034677	0.013895	0.033922	0.026907
2011	0.023788	0.054517	-0.00536	-0.01012	0.041993	0.032368	0.027848	0.028361	0.03174	0.015237	0.03166	0.02473
2012	0.017268	0.054943	-0.0062	-0.01408	0.042592	0.032539	0.02698	0.030171	0.032496	0.015835	0.034785	0.024303
2013	0.016405	0.05491	-0.00585	-0.00784	0.046077	0.032638	0.036602	0.034446	0.032587	0.020668	0.041841	0.027498
2014	0.011976	0.053209	-0.00556	-0.00629	0.045615	0.032617	0.043512	0.038232	0.035323	0.024601	0.043571	0.0288
2015	0.010545	0.055347	-0.00635	-0.01323	0.045436	0.030629	0.041732	0.039588	0.034335	0.023866	0.042772	0.027697

Appendix VII

OCA Index versus China in Total Sector (1995-2015)

Year	Hong Kong	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Thailand	Vietnam	Australia	Average
1995	0.05514	0.047933	0.061905	0.052607	0.023164	0.050381	0.028578	0.045455		0.066553	0.047968
1996	0.043388	0.044341	0.054391	0.055716	0.020277	0.041675	0.023311	0.05121		0.061926	0.044026
1997	0.037012	0.050793	0.055878	0.057925	0.026877	0.039637	0.018727	0.074442	0.030721	0.057995	0.045001
1998	0.059652	0.098335	0.055215	0.085398	0.068702	0.052712	0.038733	0.077747	0.032741	0.049472	0.061871
1999	0.018075	0.045288	0.047572	0.048855	0.014939	0.03572	0.003689	0.028077	0.030795	0.044514	0.031752
2000	0.000977	0.036205	0.039196	0.036856	0.014658	0.034169	0.005965	0.029231	0.026854	0.05321	0.027732
2001	0.022727	0.039222	0.052133	0.036331	0.033538	0.036559	0.034903	0.028183	0.024838	0.056807	0.036524
2002	0.021149	0.041064	0.052798	0.029722	0.020126	0.036401	0.018198	0.023346	0.027288	0.052591	0.032268
2003	0.014362	0.043586	0.04892	0.04885	0.019811	0.034335	0.018951	0.020804	0.024904	0.058361	0.033288
2004	-0.00372	0.044802	0.046056	0.042482	0.014084	0.02951	0.002747	0.026379	0.023354	0.056382	0.028208
2005	0.00976	0.047438	0.050701	0.050797	0.02529	0.040574	0.01657	0.038884	0.02733	0.063904	0.037125
2006	0.00793	0.0527	0.054059	0.049034	0.025994	0.040354	0.012918	0.039389	0.029786	0.067404	0.037957
2007	0.011701	0.058615	0.060052	0.057012	0.033714	0.044208	0.021453	0.049403	0.032293	0.072809	0.044126
2008	0.010385	0.047737	0.053863	0.05185	0.028816	0.039308	0.030786	0.046528	0.027066	0.057712	0.039405
2009	0.005646	0.046317	0.058393	0.047738	0.039114	0.041298	0.027292	0.044643	0.022552	0.058267	0.039126
2010	-0.01111	0.048595	0.030172	0.035355	0.017845	0.024967	0.013779	0.023547	0.02518	0.063483	0.027181
2011	-0.00323	0.048573	0.040536	0.044951	0.023003	0.038287	0.014275	0.045707	0.028914	0.061724	0.034274
2012	-0.00124	0.043402	0.028154	0.043161	0.016721	0.022833	0.016386	0.01852	0.022945	0.050808	0.026169
2013	-0.00681	0.044541	0.02258	0.040469	0.019212	0.01836	0.014043	0.034853	0.018952	0.053739	0.025994
2014	-0.00917	0.044528	0.025995	0.037296	0.015664	0.021358	0.019635	0.039316	0.012935	0.05177	0.025933
2015	-0.01204	0.04347	0.020114	0.036194	0.018334	0.019458	0.024228	0.0305	0.008385	0.049799	0.023844

Appendix VIII

OCA Index versus China in Trade Sector (1995-2015)

Year	Hong Kong	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Thailand	Vietnam	Australia	Average
1995	0.029323	0.033161	0.047132	0.022599	0.021641	0.043847	0.029979	0.029505		0.05261	0.034422
1996	0.019996	0.030845	0.042312	0.025587	0.017893	0.031493	0.024653	0.034895		0.048933	0.030734
1997	0.014877	0.040267	0.046855	0.028292	0.024489	0.031339	0.018983	0.062155	0.027947	0.046563	0.034177
1998	0.04973	0.097842	0.049482	0.063339	0.071306	0.047002	0.051489	0.074275	0.031918	0.039657	0.057604
1999	0.019689	0.047552	0.045549	0.029186	0.022524	0.033585	0.021447	0.030206	0.034239	0.037649	0.032162
2000	0.001768	0.035267	0.037406	0.017445	0.018225	0.031631	0.016412	0.032807	0.0298	0.04479	0.026555
2001	0.026239	0.039669	0.045046	0.029344	0.044465	0.036213	0.048034	0.036102	0.031278	0.051567	0.038796
2002	0.022093	0.040075	0.048602	0.021567	0.029918	0.035911	0.031964	0.029244	0.033183	0.047023	0.033958
2003	0.014615	0.042888	0.046398	0.040042	0.031923	0.034062	0.05175	0.028477	0.033675	0.053552	0.037738
2004	-0.00925	0.042736	0.043879	0.032613	0.028766	0.028191	0.014097	0.031748	0.031301	0.051035	0.029511
2005	-0.00192	0.0455	0.05019	0.040701	0.038999	0.039297	0.029177	0.043448	0.036845	0.058977	0.038122
2006	0.001439	0.051619	0.05582	0.041308	0.042852	0.04295	0.028344	0.045542	0.043768	0.065245	0.041889
2007	0.0079	0.0545	0.060507	0.045572	0.04598	0.043873	0.030963	0.049185	0.048038	0.066959	0.045348
2008	0.007011	0.040236	0.05429	0.038224	0.037233	0.037122	0.041546	0.046845	0.036887	0.052154	0.039155
2009	0.024695	0.044108	0.069465	0.044608	0.056454	0.047187	0.049873	0.054544	0.036152	0.057055	0.048414
2010	-0.00999	0.04353	0.039341	0.028035	0.02952	0.031121	0.030032	0.029413	0.035226	0.06116	0.031738
2011	-0.00674	0.040281	0.050835	0.034464	0.034087	0.041781	0.025697	0.049583	0.031098	0.05599	0.035708
2012	-0.00164	0.034668	0.039337	0.033774	0.028022	0.022584	0.027833	0.020767	0.028041	0.045027	0.027841
2013	-0.00662	0.035682	0.037381	0.031051	0.030425	0.02178	0.02329	0.036473	0.02608	0.049075	0.028462
2014	-0.0057	0.035602	0.041528	0.028152	0.024521	0.023175	0.025627	0.040782	0.021966	0.047852	0.028351
2015	-0.0072	0.034059	0.036792	0.028406	0.025279	0.021191	0.029482	0.032033	0.016829	0.047179	0.026405

Appendix IX

OCA Index versus China in Financial Sector (1995-2015)

Year	Hong Kong	Indonesia	Japan	Korea	Malaysia	Philippines	Singapore	Thailand	Vietnam	Australia	Average
1995	0.044887	0.051269	0.056544	0.052886	0.048802	0.047873	0.035777	0.057019	0.048942	0.053691	0.049769
1996	0.044167	0.049859	0.055056	0.052386	0.04989	0.047375	0.035242	0.057518	0.047666	0.052645	0.04918
1997	0.042817	0.049267	0.054856	0.052487	0.052162	0.047498	0.036655	0.058275	0.046458	0.051968	0.049244
1998	0.038846	0.044265	0.054916	0.049375	0.04957	0.045803	0.030332	0.053435	0.04617	0.052351	0.046506
1999	0.032216	0.039693	0.053142	0.048	0.04527	0.042785	0.02808	0.047921	0.043315	0.051429	0.043185
2000	0.029326	0.040414	0.051692	0.047492	0.04644	0.042802	0.030923	0.044944	0.043205	0.052628	0.042987
2001	0.027504	0.039427	0.051228	0.042012	0.041369	0.040808	0.030647	0.041096	0.04082	0.050665	0.040558
2002	0.025389	0.040003	0.047792	0.04248	0.04052	0.040127	0.027792	0.041534	0.040817	0.050845	0.03973
2003	0.019339	0.039302	0.045459	0.041181	0.037208	0.03901	0.023603	0.039231	0.037815	0.049889	0.037204
2004	0.016391	0.038382	0.041927	0.037784	0.030977	0.037369	0.021477	0.038002	0.03615	0.048304	0.034676
2005	0.016243	0.036503	0.038985	0.036182	0.029836	0.034497	0.020112	0.036062	0.033607	0.046646	0.032867
2006	0.008923	0.034161	0.036116	0.034043	0.025677	0.030618	0.015286	0.032357	0.029307	0.044011	0.02905
2007	0.004915	0.033847	0.034449	0.034443	0.025716	0.02971	0.016272	0.034388	0.026049	0.045414	0.02852
2008	0.003822	0.034869	0.033707	0.035741	0.028527	0.030066	0.016481	0.032498	0.028014	0.044514	0.028824
2009	-0.00835	0.032204	0.030148	0.029396	0.024226	0.026643	0.010927	0.026899	0.028425	0.042979	0.02435
2010	-0.00305	0.032733	0.029917	0.030382	0.026765	0.026081	0.012795	0.028079	0.030127	0.04267	0.02565
2011	0.000547	0.033906	0.02882	0.032105	0.026249	0.026949	0.016918	0.030386	0.031878	0.043284	0.027104
2012	-0.00205	0.034616	0.029044	0.031737	0.027478	0.027797	0.017568	0.032247	0.028295	0.043494	0.027023
2013	0.000399	0.034673	0.027116	0.032801	0.028052	0.026178	0.018653	0.033994	0.026352	0.042177	0.027039
2014	0.002266	0.035014	0.027488	0.035398	0.031126	0.028173	0.021856	0.035447	0.024951	0.042542	0.028426
2015	-0.00105	0.037034	0.028434	0.036418	0.034191	0.029737	0.023242	0.037194	0.027273	0.045283	0.029776

Appendix X

OCA Index versus Japan in Total Sector (1995-2015)

Year	Korea	Malaysia	Philiippines	Singapore	Thailand	Vietnam	Australia	China	Hong Kong	Indonesia	Average
1995	0.073263	0.073831	0.059691	0.045079	0.077884		0.066743	0.066702	0.066771	0.067576	0.066393
1996	0.068932	0.07456	0.059767	0.04469	0.073883		0.065976	0.062065	0.065579	0.065367	0.064535
1997	0.07358	0.081291	0.066697	0.058232	0.082111	0.068547	0.072919	0.065781	0.072007	0.06597	0.070713
1998	0.069345	0.078828	0.056654	0.038297	0.082432	0.069592	0.080805	0.069041	0.071556	0.074722	0.069127
1999	0.083716	0.072075	0.059142	0.047306	0.072045	0.061648	0.07942	0.065582	0.060367	0.04721	0.064851
2000	0.06939	0.070254	0.053284	0.047572	0.058483	0.056088	0.069921	0.059024	0.059486	0.046537	0.059004
2001	0.06106	0.052635	0.053235	0.037879	0.057026	0.0587	0.069147	0.060413	0.047349	0.049174	0.054662
2002	0.064367	0.060078	0.050063	0.03575	0.059416	0.056293	0.07008	0.057092	0.045373	0.049717	0.054823
2003	0.049519	0.05354	0.048418	0.031937	0.055913	0.050689	0.063833	0.052362	0.040415	0.047325	0.049395
2004	0.047571	0.045149	0.046852	0.034323	0.051139	0.049529	0.063301	0.045218	0.050128	0.045414	0.047862
2005	0.047457	0.045242	0.044288	0.034509	0.04787	0.049866	0.062878	0.044952	0.051153	0.048262	0.047648
2006	0.0507	0.044055	0.043806	0.034149	0.047614	0.045794	0.061918	0.044298	0.046869	0.047791	0.046699
2007	0.049279	0.042303	0.043496	0.033703	0.04808	0.039661	0.064187	0.043712	0.039709	0.046794	0.045092
2008	0.053502	0.049229	0.045446	0.026933	0.044603	0.045152	0.069432	0.039494	0.036424	0.054479	0.046469
2009	0.051782	0.043179	0.045616	0.025325	0.043407	0.059862	0.076197	0.045449	0.019288	0.060932	0.047104
2010	0.043877	0.04365	0.037513	0.039245	0.040224	0.043505	0.06328	0.027231	0.02812	0.042859	0.04095
2011	0.046808	0.043965	0.036229	0.033964	0.036753	0.050805	0.062253	0.033647	0.038523	0.050879	0.043383
2012	0.039999	0.042845	0.039158	0.026359	0.050296	0.039373	0.062562	0.028082	0.025973	0.048472	0.040312
2013	0.042332	0.041422	0.036123	0.028023	0.042236	0.036933	0.056229	0.024135	0.035725	0.045894	0.038905
2014	0.050856	0.051024	0.038868	0.03286	0.043095	0.039114	0.058608	0.027687	0.036241	0.04743	0.042578
2015	0.046054	0.049013	0.035844	0.023927	0.044523	0.040201	0.057962	0.026746	0.022312	0.044681	0.039126

Appendix XI

OCA Index versus Japan in Trade Sector (1995-2015)

Year	Korea	Malaysia	Philiippines	Singapore	Thailand	Vietnam	Australia	China	Hong Kong	Indonesia	Average
1995	0.054107	0.049953	0.062979	0.043363	0.056037		0.058093	0.05439	0.041409	0.058107	0.05316
1996	0.052116	0.04933	0.058528	0.043573	0.05341		0.058694	0.052687	0.042475	0.05787	0.052076
1997	0.053739	0.049797	0.058899	0.052138	0.05518	0.073876	0.062276	0.054944	0.048828	0.057094	0.056677
1998	0.054814	0.050222	0.052268	0.045809	0.05925	0.075672	0.067592	0.056993	0.053372	0.064924	0.058092
1999	0.062954	0.044542	0.055191	0.049216	0.055384	0.069882	0.066329	0.053996	0.049134	0.050467	0.055709
2000	0.052258	0.039511	0.049065	0.044849	0.046073	0.062917	0.059096	0.048192	0.049476	0.046977	0.049841
2001	0.051583	0.033684	0.052154	0.040016	0.048502	0.067029	0.060361	0.051418	0.042967	0.051107	0.049882
2002	0.056967	0.047091	0.053859	0.046124	0.054615	0.068795	0.064185	0.052136	0.045653	0.057253	0.054668
2003	0.04662	0.045672	0.05243	0.057651	0.052726	0.064863	0.059519	0.048583	0.042516	0.055341	0.052592
2004	0.046377	0.044929	0.048316	0.047893	0.048129	0.062489	0.058754	0.04505	0.047393	0.052846	0.050217
2005	0.045171	0.045614	0.050117	0.048771	0.044662	0.063014	0.056891	0.046676	0.045416	0.054281	0.050061
2006	0.046907	0.046969	0.05232	0.050156	0.046753	0.060686	0.056302	0.048238	0.046046	0.054517	0.050889
2007	0.046716	0.047972	0.056631	0.051813	0.047151	0.058929	0.056318	0.049007	0.046261	0.055748	0.051655
2008	0.045973	0.047522	0.05695	0.042582	0.044999	0.056845	0.057096	0.044992	0.043704	0.058272	0.049893
2009	0.051235	0.048062	0.060157	0.050867	0.051307	0.06814	0.06351	0.053007	0.044983	0.067001	0.055827
2010	0.042965	0.043982	0.056088	0.057242	0.046191	0.051693	0.05364	0.037357	0.041542	0.052976	0.048367
2011	0.042789	0.044731	0.055695	0.050231	0.04114	0.053201	0.052405	0.040602	0.044569	0.057541	0.04829
2012	0.038852	0.04321	0.055067	0.044651	0.04876	0.04671	0.052731	0.036114	0.037228	0.055649	0.045897
2013	0.040366	0.044004	0.055323	0.047551	0.043129	0.046667	0.051846	0.035826	0.041324	0.055645	0.046168
2014	0.044356	0.049336	0.054643	0.049311	0.043308	0.049663	0.05487	0.037501	0.044027	0.058253	0.048527
2015	0.043989	0.049796	0.054173	0.04624	0.046262	0.050168	0.055575	0.036509	0.044899	0.058129	0.048574

Appendix XII

OCA Index versus Japan in Financial Sector (1995-2015)

Year	Korea	Malaysia	Philiippines	Singapore	Thailand	Vietnam	Australia	China	Hong Kong	Indonesia	Average
1995	0.06594	0.067731	0.061128	0.046046	0.075138	0.059215	0.069547	0.060637	0.067749	0.065081	0.063821
1996	0.066131	0.070178	0.061483	0.046041	0.076546	0.058392	0.069144	0.059505	0.067754	0.064383	0.063956
1997	0.069573	0.076865	0.06543	0.05134	0.082165	0.060141	0.071501	0.060808	0.068265	0.067069	0.067316
1998	0.067501	0.074302	0.063766	0.046751	0.078115	0.061108	0.0733	0.062628	0.067293	0.061818	0.065658
1999	0.067336	0.070302	0.061031	0.045593	0.072277	0.05928	0.073307	0.062278	0.061699	0.057099	0.06302
2000	0.065348	0.069139	0.058863	0.045783	0.066498	0.057829	0.072585	0.060697	0.056909	0.055494	0.060915
2001	0.0622	0.064	0.056043	0.045952	0.061388	0.05519	0.07005	0.056829	0.054589	0.053661	0.05799
2002	0.059623	0.058999	0.051939	0.038483	0.058015	0.051834	0.066879	0.052834	0.048994	0.05077	0.053837
2003	0.057722	0.054627	0.050494	0.033502	0.055762	0.048823	0.066184	0.050436	0.043511	0.049948	0.051101
2004	0.053493	0.046559	0.048751	0.030435	0.054098	0.047764	0.064847	0.045244	0.040805	0.04897	0.048097
2005	0.054126	0.047081	0.047313	0.031071	0.053774	0.04711	0.065248	0.041468	0.042354	0.048897	0.047844
2006	0.054297	0.044398	0.045205	0.027955	0.051005	0.044471	0.064587	0.038014	0.037587	0.047994	0.045551
2007	0.052856	0.041846	0.04172	0.02692	0.050997	0.03968	0.065107	0.034879	0.032512	0.045402	0.043192
2008	0.055857	0.046004	0.042784	0.029125	0.049266	0.042405	0.065383	0.034573	0.031833	0.047092	0.044432
2009	0.051434	0.045501	0.041886	0.026128	0.045757	0.047499	0.066398	0.033986	0.020738	0.046895	0.042622
2010	0.050921	0.046493	0.039391	0.026308	0.045525	0.049133	0.065056	0.033802	0.025905	0.045801	0.042833
2011	0.05093	0.04383	0.037971	0.029817	0.047307	0.047753	0.063516	0.033431	0.028465	0.045068	0.042809
2012	0.050342	0.045443	0.038676	0.030536	0.049612	0.04334	0.063693	0.034748	0.025512	0.04585	0.042775
2013	0.051501	0.045917	0.037054	0.031094	0.051752	0.041234	0.061646	0.03297	0.029635	0.045358	0.042816
2014	0.054403	0.048517	0.038642	0.0341	0.052669	0.039032	0.061027	0.034148	0.031785	0.044486	0.043881
2015	0.053305	0.049507	0.038125	0.032593	0.052149	0.040253	0.062304	0.036377	0.02503	0.0443	0.043394